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ENGLISH SEAMEN AND DIVERS.

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BY

ALPHONSE ESQUIROS,

AUTHOR OF

"THE ENGLISH AT HOME," ETC.

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ENGLISH SEAMEN AND DIVERS.

CHAPTER I.

INFLUENCE OF ASTRONOMY ON THE PROGRESS OF NAVIGATION—GREENWICH PARK—THE DEER—"KISS IN THE RING"—EXTERNAL APPEARANCE OF THE OBSERVATORY—MR. GEORGE BIDDELL AIRY—HOROSCOPES—LE SIEUR DE SAINT PIERRE AND CHARLES THE SECOND—FLAMSTEED AND NEWTON—THE ASTRONOMERS ROYAL—THE OCTAGONAL ROOM—THE BOARD OF VISITORS—THE DUTIES OF THE ASTRONOMER ROYAL—HIS ASSISTANTS AND COMPUTERS—THE LIBRARY AND THE MANUSCRIPT ROOM—CHARACTERISTICS AND SPECIAL BUSINESS OF GREENWICH OBSERVATORY—NAUTICAL ASTRONOMY—FLAMSTEED'S WELL.

THE development of the art of Navigation creates a necessity for scientific attainments of various kinds; but still astronomy is that one chief science which would be cultivated in preference by any nation ambitious to gain the empire of the seas. The contrast between the English and French character nowhere stands out more prominently than in the pursuit of science. When our neighbours study one of Nature's laws, it is with a view of adding to their means of power. All that they know they instantly apply. This tendency to the actual, and to material achieve-

ments, naturally drives out a mere taste for theories. One may follow out the traces of this constitution of mind both in public matters and in industrial pursuits; but this strong, practical good sense has especially set its stamp on everything connected with the organization of navigation and nautical matters generally. The class of attainments that is cultivated, for instance, at Greenwich Observatory, always tends to invest itself with some special character of utility. I should like to give my readers some idea of this institution, and the services which the English nation requires from it. It is, in any way, no bad introduction to a study of nautical matters as they are in England. Greenwich Observatory should hardly be separated from the interests of the great fleets for the benefit of which it was founded; guiding, as it does, by an earnest study of the celestial movements, their distant voyages over the surface of every sea.

Greenwich takes an honourable place among the ancient historical towns of England. Edward IV. resided here; here, too, in a palace, now no longer existing, Henry VIII., Mary Tudor, and Queen Elizabeth had their birthplace.

In a tavern, standing on the banks of the Thames, the famous *whitebait dinner* still takes place every year, at the end of the session of parliament. This farewell dinner, which brings together at Greenwich all the Ministers of State, takes its name from a *plat*

composed of the *whitebait*, a very small fish, caught a little way down the river, which, cooked according to all the rules of art, forms one of the delicacies of the English *cuisine*. Two parallel streets, crossing the whole length of the town, lead from the water's edge up to two iron gates opening into the park; the latter was laid out by Le Notre in the days of Charles II., and was enclosed by walls in the reign of James I. The ground at first entering is flat and uniform in surface, but soon rises abruptly into a hill planted with firs and other evergreen trees. The summit of this eminence, which we must climb by a narrow path, is surmounted by a terrace, the prospect from which stretches as far as the eye can reach over an horizon perhaps unequalled in the world. There certainly exist many views more attractive to the landscape-painter, but where will you find one that gives a grander idea of man and of the conquests of mind over matter? Where could we look for a like accumulation of the manifestations of power, labour, and wealth? In the foreground stand the *Royal Naval Asylum*, or school for the children of sailors, and the *Royal Hospital for Seamen*, the latter crowned with two domes, the gilding on which has been tarnished by the hand of time. A little further off, the Thames, which here doubles round in almost contiguous bends, appears all spotted over with sails and steamboats. Beyond this, and all round the background of the scene, the lofty

chimneys of the manufactories, the great ship-building yards, the forests of masts sheltered in the numerous docks, are all blended together in one misty mass in which, though indistinct to the sight, one may well recognise the triumph of maritime energy.

The park at Greenwich, planted as it is chiefly with elms and Spanish chestnuts, is remarkable for the great age of its trees: some of them, if we may place trust in tradition, may have seen Queen Elizabeth pass by. What a vigour there still remains in the twisted and knotty limbs of some of these sylvan giants! They are the real *monuments* of the vegetable kingdom; their enormous roots denuded of the earth and twined like the coils of a gigantic serpent—their immense trunks with the rugged bark carved into excrescences and scars by the hand of time—their net-work of branches either dead or covered with a dark and opaque foliage—everything tells us that they carry bravely their weight of years. Parks in England are not so artificially trimmed as our public gardens in France: in the former, on the contrary, nearly everything is left to nature. When we wander out of the wide gravel-path, we find shady walks, carpeted with fresh and fine grass. Through the glades of the wood we can hardly fail here and there to catch a glimpse of the glossy and speckled coats of the deer: these graceful creatures, about 120 in number, wander about in complete liberty over the whole extent of the enclosure, which is throughout

more or less wooded. They are so wonderfully tame that they will follow children with a kind of timid confidence, and take pieces of cake from their hands. Towards evening, during summer, it is curious to hear the hinds calling one another; the oldest among them gives the signal, which is repeated from place to place like the responsive *qui vive* of sentinels in a fortified town; groups are soon formed, and almost all the hinds, followed by their fawns, proceed in a flock towards the sheds in which they have to pass the night.

At the end of the park which is furthest from the river an iron gate leads out on to the open ground of Blackheath, celebrated for its donkey-races, and frequented by fortune-telling gipsies. On this spot Wat Tyler assembled the Kentish insurgents in the reign of Richard II.; here, too, Jack Cade and his malcontent companions held their nightly meetings in a cavern now closed up. All these localities are found to be full of the memories and remains of bygone times. In 1784 some ancient funereal barrows in the park were opened and examined; some spear-heads, knives, and human bones were found in them. Some of these artificial mounds still exist, and present a marked undulation on the grass-grown surface of the ground.

During the week Greenwich Park is generally quiet and unfrequented; the only visitors to be seen are a few people enjoying their picnics, children playing, and especially the old pensioners, some wanting an arm,

and some a leg—the living *débris* of many a naval engagement. What a different scene is presented on certain yearly festivals! On some of these days the number of pleasure-takers flowing in from all parts of London has been estimated at 100,000. Among the recreations to which the whole extent of the park is appropriated, the old English game of "kiss in the ring"* figures in the first rank. The bursts of noisy pleasure are kept up until night; and, all the time, the grave and studious-looking Observatory stands in the middle of the park, on the brow of the hill, silently looking forward to its inspection of the stars.

The *façade* of the edifice is of the time of Charles I., and is constructed of red brick, with facings and scroll-work in stone. At the present day, an observatory would hardly be constructed on such a model as this; but still, though without any pretensions to beauty, this work of architecture has at least a somewhat picturesque character. A ground-floor flanked with two low square turrets covered with zinc, a first-floor pierced with three windows, a terraced roof adorned at each end with two slender bell-turrets—such is the general aspect presented by the edifice on the side

* Rings are formed, made up sometimes of above a hundred people. A young girl walks round the ring, throws a handkerchief on to the shoulder of one of the youths, and then runs away. The latter pursues her, and when he has overtaken her in the race, leads her back into the interior of the ring, and there kisses her as the reward of his victory.

facing the Thames. A boundary-wall, which half hides the base of the edifice, extends all round the domain consecrated to science. Greenwich Observatory has this much in common with Horace: that it hates the *profanum vulgus*, and keeps them at a distance. The public are not admitted there; and, if you wish to cross the threshold, special permission from the Astronomer Royal is required, which is but rarely granted. Having, however, obtained this favour, one morning about ten o'clock (the time fixed for visits) I rang at a modest-looking door cut in the boundary-wall where it winds round from the terrace to the great avenue of the park.

Following the custom hallowed by time, the porter at the Observatory is a pensioner from Greenwich Hospital—that is, an old sailor. He conducted me into a court in front of which stands the most ancient portion of the edifice; hence a passage arched over with thin sheet-iron, supported on slender shafts, which serves as a protection against rain, leads to the private apartments of the *savant* who presides over the institution. A few trees are growing on the right of the court, and on the left a series of buildings is spread out; none of them are very lofty, and the most ancient among them do not date back for more than 125 years, the others having been added in more recent days as the number of instruments increased and the requirements of the duties extended. The official character of these buildings is indicated by an iron railing which surrounds

them. Here is situate the work-room of the Astronomer Royal, Mr. G. B. Airy.

I now entered a well-lighted apartment, the walls of which were covered with charts, engravings, photographic portraits of the moon, and Donati's famous comet, which appeared in 1858. Mr. Airy is a man of sixty-five years of age, who has grown grey in the study of the stars; his energetic features indicate the incessant activity of the strong intellect which for more than a quarter of a century has upheld the reputation of Greenwich Observatory. On his writing-table were heaped up a quantity of papers covered with calculations, and a mass of letters as to a thousand matters of business. A large iron cupboard let into the whole length of the side wall, and provided with shelves of slate, contains all the precious documents, which will, no doubt, one day serve to trace out the scientific history of the nineteenth century. Here, for instance, are preserved the letters and authentic documents which are destined to modify certain received opinions as to the discovery of the planet Neptune. In this cupboard may be also found the records of bygone errors and chimerical ideas, which one wonders to find reappearing in this enlightened age.

It is difficult to believe that many among the English still confound astronomy with judicial astrology; but Mr. Airy preserves, in a very curious collection, letters that he has received from all classes of persons asking

what his terms are for *drawing a horoscope.* Sometimes it is a young man wishing to know "who will be his wife;" at others it is a lady, on the eve of embarking in the great business of life, who desires to consult the stars. Postage-stamps are occasionally sent with these missives, and he or she who consults the oracle promises to make known, if necessary, the true day and hour of their birth. The fact is, that a great many people can scarcely understand how the astronomers can contemplate the vault of heaven by day and night without endeavouring to trace out the secret of human destiny. Some years back, a young lady dressed in good taste applied at the door of the Observatory; she felt interested in one of her near relations, a sailor in the Pacific Ocean, from whom no news had been received for several years. After she had had a few minutes' conversation with one of the assistants, she went away bathed in tears because the stars were not able to tell her if the object of her affection was still alive.*

When and in what way did the foundation of the

* This naturally recalls to our minds an episode in the life of Frederick William Herschel. During a very rainy summer, a farmer in his neighbourhood came to ask his opinion, or rather the opinion of the stars, as to the day that would best suit for making his hay without any fear of showers. The great astronomer led him to a window, and pointing with his finger to a meadow where the grass had been mowed and was rotting in the wet, "You see that field," said he; "well, it is mine. Isn't that enough to show you that, as regards rain and fine weather, I am not a bit more of a conjuror than any of my neighbours?"

Royal Observatory at Greenwich take place? In 1674, a Frenchman, named Saint Pierre, under the protection of the Duchess of Portsmouth, then in high favour at court, suggested means to Charles II. for discovering the degree of longitude for a vessel at sea. The king, although perfectly unacquainted with astronomy, was nevertheless struck with the advantage which English sailors might derive from this plan, just at the time when their navigation and commerce had begun to extend to all parts of the globe. He therefore submitted the Frenchman's views to an official commission of *savants*. Sir Jonas Moore, Inspector-General of Artillery, and mathematical teacher to the Duke of York, caused Flamsteed, already famous as an astronomer, to be included among their number. This is the problem that was propounded to them to resolve: "If the movements of the moon among the stars could be exactly predicted before a vessel left England, would not the navigators be able, by observing the situation of the moon as regards the fixed stars, to find out the exact time, and thus to determine the degree of longitude during the whole course of the voyage?" The principle was certainly unassailable; but Flamsteed correctly brought forward the fact that the lunar tables were still too defective to enable this system to be brought into application, and that the places of the fixed stars, which were to serve as the data from which to estimate the evolutions of the moon and planets,

were too often incorrectly marked in the registers of the time.

Charles II., in spite of his frivolity, was alarmed at finding such a deficiency in human acquirements, and immediately took measures for having this branch of practical astronomy cultivated under his auspices as a national science. On the ground that Greenwich Park now occupies there then stood an ancient tower, built about the year 1440 by Humphrey, Duke of Gloucester, and uncle to King Henry VI. In less than a century this tower had undergone various changes. Henry VIII. reconstructed, or at least repaired it in 1526, and, if we may believe the chronicler, used to come thither to visit a fair lady whom he loved. In the time of Elizabeth it was called *Mirefleur*, and is no doubt the place mentioned in the "Amadis des Gaules." In 1642 the name of Greenwich Castle was given to it. Sir Jonas Moore and Sir Christopher Wren, the architect of St. Paul's Cathedral, pointed out the site of this fortress to King Charles II. as the place that was best adapted for the construction of an observatory. The position, situate as it is on a hill commanding the Thames and the vessels passing, was in fact an excellent one. The old feudal tower was therefore pulled down, and over its remains was raised an edifice dedicated to the contemplation of the stars.*

* Mr. Airy showed me in the courtyard a Latin inscription over the former principal entrance of the Observatory, which plainly showed

The building was scarcely finished ere Flamsteed was installed in it with the title of Astronomer Royal, and an emolument of £100 a year. At this point, however, King Charles's bounties stopped; Flamsteed was himself compelled to procure the necessary instruments, and at his own expense to employ an auxiliary to assist him in his labours. As his slender means were not adequate to all this, he gave, in his leisure time, instruction in mathematics and astronomy to several pupils. His life was a perpetual struggle against the neglect, indifference, and bad usage of his fellow-countrymen. Though alone, and abandoned to his own individual resources, he, nevertheless, triumphed over all the obstacles which at that time were opposed to science by the rudimentary state of the instruments, and the vagueness of the existing systems. Before his time Tycho-Brahe's catalogue was the sole guide which astronomers possessed for ascertaining the position of the stars. Flamsteed undertook to personally re-examine every point, and thus to re-establish the base of celestial observations. It was just at this time that Newton, retired into

the intention of the founder, whose chief idea was to strengthen the bond of union between astronomy and navigation. The inscription runs as follows: "Carolus Secundus, rex optimus, astronomiæ et nauticæ artis patronus maximus, speculam hanc in utriusque commodum fecit. Anno Dom. 1676, regni sui 28. Curante Jona Moore." As to the origin of Greenwich Observatory, Baily's "Account of the Rev. John Flamsteed," p. 37, and the "Historia Cœlestis," vol. iii. p. 101, may also be consulted.

the country, was directing his thoughts to the subject of the solar system. He several times applied to Flamsteed in order to obtain from him some of his lunar observations, by which to support his system of universal gravitation. Thus it was that these astronomical investigations, the most exact which had been as yet made, wonderfully aided in the establishment of the most sublime discovery of modern times.*

Flamsteed had collected together, during a long course of years, all the elements for a history of the heavens, and conceived the very natural desire to publish them; but the difficulty was to find the money for the accomplishment of his wish. He formed the idea of appealing to subscribers; but in 1704, Prince George of Denmark, having heard the value of his

* The good understanding between these two celebrated men was not, however, of very long duration. Newton's disposition, there is reason to fear, was scarcely on a par with the elevation of his genius. A letter written by Flamsteed leaves unfortunately but little doubt on this point. As this letter is not much known, and is addressed to Newton himself, I may be permitted to quote it here: "The works of Eternal Providence will be, I trust, a little better understood, thanks to your labours and mine. You must not think that it is pride which dictates this expression; I look upon pride as the worst of vices, and humility as the greatest of virtues. This feeling induces me to readily excuse the faults of mankind, to put up with gross insults without resentment, and inspires me with the resolution to preserve a genuine friendship for men of genius, to the extent of assisting them as often as it is in my power, without any other interest than that of doing them good and obliging them."

observations highly spoken of, proposed to have them published at his own expense. The first volume appeared at the end of three years; but the Prince died, and the whole burden of the expense was, in consequence, thrown upon Flamsteed. He did not even have the consolation of seeing the completion of his work; he went down to the tomb in 1719, before the second and third volume of the "Historia Cælestis" had perpetuated his memory.* He had presided over the new establishment for more than half a century, and had spent more than £2,000 of his own money. His works will always be looked upon in England as the starting-point of modern astronomy. He it is who, much more than Charles II., ought to be deemed the founder of Greenwich Observatory.

Halley, famous for his travels undertaken in the cause of science, for his work on comets, and for his general acquirements in what the English call natural philosophy, was sixty-four years of age when he was nominated as Astronomer Royal; he died in 1742. Bradley, who succeeded him, is for ever distinguished for two of the most beautiful discoveries that have been made in astronomy—the aberration of light and the nutation of the earth's axis. In 1749 he had new

* The printing was superintended, after the death of Flamsteed, by his assistant, Joseph Crosthwaite, and Abraham Sharp, whose name is known in connection with several instruments which are very remarkable for the epoch in which he lived.

astronomical instruments set up in Greenwich Observatory; and from the following year (1750) dates that series of experiments and calculations which are the real characteristics of this institution. He left, besides, an immense collection of his observations on all the phenomena which were to be noticed in the heavens during nearly ten consecutive years of the middle of the last century. After his death the direction of these astronomical labours passed into the hands of Nathaniel Bliss, and next of Dr. Nevil Maskelyne, the author of four volumes, of which it was said by Delambre, "that if, in consequence of some great revolution, every record of science had been utterly lost, with the exception of this collection, in it would be found materials quite sufficient for building up again the edifice of modern astronomy." Maskelyne was followed by John Pond, who died in 1835; his place is now supplied at Greenwich by Mr. Airy, the present Astronomer Royal.*

Even the residence of a succession of such celebrated men is calculated to inspire one with a species of respect. Mr. Airy first of all conducted me into what is called the Octagonal Room, where may be seen the portraits of all the most famous astronomers. It is a fine room, occupying the first floor above the apartments on the ground level, and was constructed from

* As Professor at the observatory in the University of Cambridge, Mr. Airy had already become well known by his learned labours.

the designs of Sir Christopher Wren. Lighted with lofty windows, and ornamented with arabesques in rather a grand style, this room, which at first formed nearly the whole of the Observatory, has but one defect —it is not at all well suited for the study of the stars. It has, therefore, of late been converted into a mere reception-room. In it, once a year, on the first Saturday in June, the Board of Visitors is assembled.

This council was first instituted in 1710, in the reign of Queen Anne, for the purpose of pointing out certain objects for the researches of the Astronomer Royal, of inspecting the condition of the instruments, and making arrangements with the Lords of the Admiralty as to all matters connected with the Observatory. In Flamsteed's time, Sir Isaac Newton, in his capacity as President of the Royal Society, was at the head of the visitors. This circumstance was a cause of displeasure to Flamsteed, who, embittered by underhand persecutions, fancied that he detected a fresh infraction of his privileges in this intervention of a foreign body, and especially in the superintendence of an easily offended rival. At the present day the relations between the Board of Visitors and the Astronomer Royal are of a very different character. The first Saturday in June is now, on the contrary, quite a day of festival, and an agreeable anniversary. Every door in the Observatory is thrown open to welcome the

Presidents of the Royal Society and of the Royal Astronomical Society, the Professor of Astronomy at the University of Oxford, the Professor of Astronomy and Experimental Philosophy at Cambridge, with other *savants* as well, who, sixteen in number, make up the Board of Visitors. The meeting is held in the Octagonal Room, where the staff of the Observatory is kept, so to speak, under arms, and where the Astronomer Royal reads to the visitors his annual scientific report, written and printed for the occasion.*

With the exception of this very slight bond of union connecting the chief of the institution with the superintendence of a council, he is independent, which in England also means responsible. He is nominated by the First Lord of the Treasury, and performs his functions under the warrant of the Great Seal of State; his salary is fixed at £800 *per annum*. One of his principal duties is to preserve for Greenwich Observatory that character which the founder himself wished to impress upon it. The Astronomer Royal is consequently bound by the express terms of his commission "to devote himself with the greatest care to correcting the tables of the celestial movements, and to determining the positions

* These "Reports of the Astronomer Royal to the Board of Visitors," extending from the 4th June, 1836, to the 2nd June, 1866, will some day furnish invaluable materials for a history of astronomy in England during the middle of the nineteenth century.

of the fixed stars, in order to furnish the long-desired means of discovering the longitude at sea, and of thus bringing to perfection the art of navigation." It is also necessary that he should reside in the Observatory, and devote all his time to the duties of his office, never absenting himself for any long period without having previously obtained the sanction of the Lords of the Admiralty. Consulted, as he is, by various branches of the Government, he is able to render assistance to the public service by his advice and information, well assured that he himself can never be affected by any of the changes in official power, or by any of the results of political conflict. His residence has a garden attached to it, which is parted off from the grounds of the park, and well planted with fruit trees. He has under his control eight assistants, and, ordinarily, six computers.

The assistants are, for the most part, chosen by the Astronomer Royal, but their nomination is submitted to the Lords of the Admiralty. The candidates who offer themselves for the vacant situations have to undergo an examination by the chief of the Observatory on subjects connected with the duties which they would be called upon to fulfil. The course of acquirements which is to be exacted at each advancement in rank is definitely drawn out. One of the results of this system has been that they have thrown aside the old custom of promotion in order of seniority,

which, however, has never flourished very vigorously at Greenwich Observatory. The assistants are advanced according to their merit, and the Astronomer looks upon it as his duty to perfect their scientific education. None of them reside in the Observatory, but they receive an allowance beyond their salaries to provide for the rent of a house.* The head assistant, who is very often a Fellow of one of the Colleges of Oxford or Cambridge, takes the place of the Astronomer Royal in case of his absence; but no matter what confidence may be extended to these assistants, be their standing high or low, it is the chief of the establishment personally who has to answer to the Government and the public for the value of his observations.

The supernumeraries, or *computers*, differ from the assistants in being left almost entirely at the disposal of one single individual. The last-named officers can only be dismissed by the Lords of the Admiralty; but the computers are engaged and discharged by the Astronomer Royal. In order to understand the duties of these *employés*, it is necessary to know that the most delicate and minute observations of the heavens, although they may occupy many long hours, are as nothing in respect to the time they employ, compared

* The head assistant receives £400 a year, and an annual allowance of £70 for the expense of house-rent. The salary of the lowest assistant is £100, and £30 a year is also allowed him.

with the calculations which they afterwards require to reduce them to a tangible form. It is curious to see these computers in their two offices, one situated on the ground-floor, near the study of the Astronomer Royal, and the other isolated in one of the quietest parts of the Observatory, all sedately occupied in reckoning up, from morning till night, dull columns of figures. The greater part of them are altogether ignorant of astronomy; they calculate blindly, without discriminately knowing what they are attempting to prove; "and these do the best," added Mr. Airy, smiling.

A library is attached to the Observatory; this naturally is principally composed of books on astronomy, mathematics, and the terrestrial system. The idea which predominated in the formation of this library, and in the choice of the works in it, well deserves to be commemorated. The assistants are all able men who make astronomical science both their study and profession; but the mass of routine work which regularly falls upon them is so great, that if care was not taken, the establishment might degenerate into a mere office full of clerks. In order to avoid this contagion of mere matter of fact, and to counteract certain too practical tendencies, Mr. Airy thought that it would be advantageous to his assistants and co-operators if they were furnished with means of making themselves familiar with scientific literature generally. Thanks

to this collection of selected works, they are enabled to study all the systems of foreign philosophers, and the theories of both ancient and modern times. By these means a man does not stagnate in a narrow round of duties, and the character of the Astronomer can still assert its pre-eminence over that of the mere observer of facts. The director, in the course of action, has had in view not only the present, but the future efficiency of the institution. Is not increasing the acquirements and the education of his staff, and preparing for his successors the elements of a more extended system of philosophy, the best plan he could pursue for elevating the moral value of the institution under his charge?

I likewise visited the Manuscript Room, constructed of iron, so as to guard against any danger from conflagration. No fire is ever lighted here; but the walls are kept dry during winter by means of hot-air pipes. Here, covered with venerable dust, repose the plans for the Observatory, engraved probably from the designs of Flamsteed; also Bradley's manuscripts, and many other records very precious to science. In this collection figure, moreover, all the observations made at Greenwich of the moon and planets from the year 1750 down to our own days, all reduced to tables by Mr. Airy. What voluminous archives of the heavens!

It is my wish to point out clearly the characteristics of this astronomical institution.

Before describing what Greenwich Observatory *is*,

it would perhaps be better first to state what it *is not*. It relinquishes to other inquirers the task of discovering spots in the sun and mountains in the moon. The observations of the assistants are not directed either to the figures of the planets or to the extraordinary movements of the double stars revolving one round the other in the depths of the firmament, or the mysteries of the *nebulæ*. What motives can be brought forward by the authorities of the Observatory for abandoning these vast fields of astronomical inquiry? Phenomena of this kind, we are told, present in themselves so many charms to the mind, that they will never want for enthusiastic observers. The solution of double stars, for instance, as well as the problems connected with the subject, forms one of the most important objects of study at Cambridge and at Pulkowa, in Russia. It is just the same with comets; the instruments in other public, and even private, observatories are so powerfully adapted for watching the arrival of these eccentric visitors, and the methods for reducing to calculation the evidences acquired by observation have reached such a degree of exactitude, that it would be a loss of time if similar researches were often instituted at Greenwich. The establishment, on the contrary, has sought to concentrate its efforts on matters that were not investigated elsewhere, or, at any rate, not done so well.

What a firmness of character, what a truly English

strength of will, have these observers shown in voluntarily drawing a veil over some of the most splendid wonders of the heavens! At the time of John Pond, a telescope, twenty feet in length, had been erected in the establishment at great expense; but as it was a strong attraction to visitors, he caused the instrument to be dismantled. About the year 1847, when Mr. Airy was Astronomer Royal, M. Lerebours offered to Greenwich Observatory the largest refracting telescope which had ever been constructed. The temptation was certainly a great one; it would have been flattering to the self-esteem of the institution to have possessed a wonder of this sort, unique as it was in the world. Mr. Airy need only have said the word, and the Lords of the Admiralty would assuredly have consented to make the purchase. But the Astronomer, on the contrary, held the present aloof with a determined hand. What was it that he feared? The perfidious influence of such a siren, which, by concentrating attention on the beauties of the heavens, would, perhaps, have turned away the attention of the assistants from their daily task, and thus compromised the success of the Observatory.

In accordance with the English principle of division of labour, the establishment at Greenwich has traced out in the sphere of the celestial phenomena a certain limit for its researches, and has retained for itself the most laborious, and perhaps the most unthankful,

portion. At all events, it is the portion which exacts the greatest amount of calculations, the most extreme precision in the instruments, and an indefatigable continuity in the system of observations. In fact, but one branch of astronomy is really followed up in Bradley's old abode, and this branch is the most practical one, and that which relates directly to navigation. The observations are directed day and night to the sun, the moon, the planets, and certain stars, in their passage to the meridian; but, in this way, the studies gain in depth all that they lose in extent. It is, in fact, to this very limitation of inquiry that the universal renown of the Observatory is attributed by the *savants*. Thus, all superfluous instruments, foreign to the practical object in view, are either rejected or received but coldly. We must not, however, misunderstand the sense of this word *practical;* the delicate observations which are being carried on at Greenwich, on account of the very precision which distinguishes them, serve as the ground-work for the greater part of the speculative views which are taken up as to the system of the universe.

An inspection of the instruments in the possession of this Observatory will place one in a better position to grasp the aim and end of their scientific inquiries. From the days of Flamsteed there has existed at Greenwich, and also in the greater part of the old establishments of the same kind, a dry well, measuring

100 feet in depth, into which they descended by means of stone steps to observe the stars during the day-time. The progress now made in the construction of telescopes has rendered this plan useless. This well, therefore, for a long time past, has been arched over. At the present day, we must visit the various parts of the building to find the instruments which are the actual celestial *spies* designed to extend the short span of our senses, and to clear away the errors they give rise to. Three of these instruments especially deserve our attention: they are the *transit-circle*, the *altazimuth*, and the *great equatorial*.

CHAPTER II.

BYGONE ASTRONOMICAL INSTRUMENTS—THE PRESENT TRANSIT-CIRCLE—A NIGHT IN THE OBSERVATORY—APPARITION OF A STAR IN THE FIELD OF THE TELESCOPE—MODE OF OBSERVING ITS TRANSIT—INEQUALITY IN THE PHENOMENA OF SIGHT—HOW THIS SOURCE OF ERRORS IS RECTIFIED—THE SIDÉREAL CLOCK—THE ART OF COUNTING SECONDS WITHOUT LOOKING AT THE DIAL—THE HEAVENLY BODIES CHIEFLY WATCHED AT GREENWICH OBSERVATORY—THE NAUTICAL ALMANACK—HOW TO FIND THE LONGITUDE AT SEA—THE ALTAZIMUTH—PHASES OF THE MOON—THE GREAT EQUATORIAL—ARE THE HEAVENLY BODIES INHABITED?—FACE OF THE MOON, OF VENUS, OF JUPITER, AND OF MERCURY—INSTRUMENT WHICH WRITES DOWN THE EXACT TIME OF THE TRANSIT OF STARS AND OTHER CELESTIAL PHENOMENA—INTERESTING EXPERIMENTS TO DETERMINE THE DIFFERENCE OF LONGITUDE BETWEEN GREENWICH OBSERVATORY AND THOSE OF PARIS AND BRUSSELS—TELEGRAPHIC CORRESPONDENCE BETWEEN GREENWICH AND VALENTIA—THE BOUNDARIES OF TWO COUNTRIES FIXED BY ASTRONOMICAL OBSERVATIONS.

We first enter an apartment on the ground-floor called the Transit-circle Room, in the middle of which stands a stone and metal construction erected about the end of 1850. The entire *matériel* of the Observatory has been renewed within the last thirty years, and the former destination of many of the rooms is now-a-days entirely changed. Not a single one of the instruments which were still in use at the time of the appointment of the present Astronomer Royal is now

operated with at Greenwich. What, then, has been the fate of these dumb auxiliaries of science? We shall find them hung at intervals on the walls of the rooms opening on a level with the court. Here, for instance, our attention is attracted by a *quadrant*, the work of Abraham Sharp. This precious relic had been sold for old copper to a travelling tinker, and was presented to the Observatory, in 1865, by the Rev. N. S. Heineke. In another place we notice the *transit* of Dr. Halley, also that of Bradley, which was in its turn dethroned by an improved instrument now itself belonging to the past. In this series of the avatars and fossils of science, if we may so call them, we follow as it were step by step the mechanical advances of astronomy.

Some of these inventions, now quite superseded, have yet had in their time their day of fame, and have rendered eminent services to the intelligence of man: witness this great *zenith-sector*, which was made by Graham, a famous English watch-maker, by means of which Bradley was enabled to perceive the aberration of the stars. Almost all these wood-constructed circles, the *radii* of which, all converging to a centre, recall to one's mind, at first sight, the appearance of a common carriage-wheel, have, after all, some title to our respect and gratitude on account of the important discoveries with which they have been connected. Besides, the sight of these relinquished implements cannot fail to

inspire one with somewhat melancholy thoughts. Will not all the store of modern appliances which have succeeded them, in their turn too, partake the same fate? Will not the day come when these very triumphs of the astronomer and the machinist, which are now, with a just pride, spread over the rooms of the Observatory, will be replaced by instruments still more perfect, and will retire to their resting-place on the walls, together with all the other trophies of time? It is the history of science, advancing like nature by a series of developments, fated, in an ever on-going succession, to swallow up one another.

The astronomers at Greenwich consider their present *transit-circle* as the most perfect prototype existing in the world. The other instruments of the same kind that are to be met with in various observatories—for instance, at the Cape of Good Hope and at Cadiz—are nothing but copies from this model, though it is certainly true that, as often happens in such cases, the children have profited by the errors and experience of their father.* For any one who is ignorant of astronomy, a scientific implement of this kind presents, at first sight, something more than an enigma; but few could fail to be struck with the grandeur of the work, in which one recognises immediately the principal features of

* The improvement subsequently introduced into the telescopes imitated from the one at Greenwich is the perforation of the central tube.

the English character—precision and strength. The transit-circle, as its name shows, is a combination of two instruments which have been in use for a long time at Greenwich Observatory—one which serves to discover the stars in their passage to the meridian, and another, called the *mural-circle*, which measures the angular distance of the same stars at the stage of declination.

In order to fulfil the first requirement—that is, the observation of the heavenly bodies—there stands an immense telescope resembling a heavy cannon mounted on a stone carriage. It is 12 feet long, is constructed of cast metal, and is composed of four large pieces separately made, but joined to one another very firmly. Its object-glass, the opening of which measures more than 8 inches in diameter, and somewhat resembles the eye of a Cyclops, is not endued with any very great magnifying power. For many purposes this would be a defect, but it must be understood that this glass is by no means intended to explore the heavens, or to hunt out in infinite space those stars which elude even an assisted vision. The quality that is in this case most demanded is that it should be well lighted on the inside, and in this respect it fully comes up to the conditions required. A new apparatus gives the means even of governing the light in it, and of wonderfully adapting it to the nature of the celestial phenomena which the observer intends to examine. This tele-

scope is supported in the air by an axis turning on two pivots, and by means of screws can be elevated or depressed at will. It is really curious to observe with what docility this heavy mass obeys the slightest impulse of the finger. Its movements, however, are limited to a downward direction, for it is always necessary that the telescope should be pointed exactly in the direction of due north or south, and the least deviation in this respect, be it only a hair's breadth, would produce a fertile source of errors. To keep it exactly in its position they make use of two tubes and a vessel of mercury as a levelling-gauge.

As regards the second operation—that which consists in measuring the distances and fixing the position of the stars in their movement of declination—it is managed by a circle attached to the instrument, in which is inserted a thin strip of silver engraved with very fine lines at an equal distance from one another. These lines or divisions are afterwards shown magnified by powerful microscopes, the field of which is illuminated by the play of gas; they are themselves enclosed in an opening hollowed out in one of the massive stone piers between which the telescope is fixed for working. In order to thoroughly understand this instrument it is quite necessary to see it in action.

An observation of the sun takes place at least once a week at mid-day, in the Transit-circle Room, and a

large portion of the staff of the establishment takes a part in it; but it is at night that one can form the best idea of the mode in which the transit of the celestial bodies over the meridian is duly verified. A list of the planets and stars that it is expedient to watch is made out on Monday morning by the Astronomer Royal, or under his direction, and the list, placed over the mantel-piece in the computing-room, points out beforehand the arrangements for the week as regards each assistant. The first observations made with the new transit-circle date from 1851, and from that time to the present they have never been discontinued. The assistant who is appointed, aided by this instrument, to watch the state of the heavens, is on guard for twenty-four hours.* Except under extraordinary circumstances, the same duties are never assigned to an assistant two days running. Having already worked some hours after sunset, he goes home to take his evening meal, and when he returns into the Transit-circle Room it is quite night. The shutters which, during the day, shut in a part of the ceiling are now unclosed, and by means of this aperture the whole sky seems thrown open to the room.

Having consulted his list of the luminaries that he has to observe, and noted the time of their transit and their approximate position in the sky, the Astronomer

* From three in the morning until three in the morning the next day.

adjusts the telescope by means of projecting handles until he has succeeded in fixing it in the required direction. This being done, he sits down in a comfortable arm-chair, the back of which can be lowered at will. The higher in the heavens the object is which he wishes to reach with his eye, the further back he must lie to be able to see it. If, for instance, he has to deal with a star situated near the zenith, the observer has to lie down completely on his back. For some time nothing appears; but the assistant on duty keeps on the *qui vive*. His intentness can only be compared to that of a sportsman, or still better to that of a pointer-dog, only, instead of a partridge or a woodcock, he is eagerly waiting to see a star *get up*. There it is at last! It comes into view quick and sudden as a meteor. Scarcely has it entered into the telescopic field of sight than it appears to approach rapidly some objects which look like a series of transverse iron bars placed at equal distances from each other. These, however, in reality are nothing but threads of the thickness of a spider's web, stretched according to a system in the interior of the telescope, and wonderfully magnified by the power of the lenses.

At the moment when the anticipated star passes behind the first thread, the observer presses his finger on an ivory key attached to the instrument, which instantaneously awakens a current of electricity, the

course and action of which must be followed into another apartment, called the Chronographic Room, For the present, let it suffice for us to know that this movement of the finger announces the development of facts just as they are taking place in the interior of the telescope, and step by step exactly as they are presented to the view. This is called "rapping a transit:" this flattened knob actually raps by the play of its spring, and in this respect the astronomers at Greenwich are the *rapping spirits* for the celestial phenomena. Each of them has his own peculiar way of touching the ivory key, and amid the silence of the night it can be immediately recognised by the other assistants, and they can tell, even without opening the door, which of them it is that is operating in the room. It is, besides, asserted that certain shades of disposition or certain emotions of the mind—such as impatience or restlessness—will tend to impress a peculiar tone on the vibration of the instrument.

Always on the watch, the observer has never for an instant lost sight of the star under his inspection, gliding in succession across the nine threads which divide the telescopic field of view, and every time that it is detected behind one of these threads, a fresh movement of the finger and another sharp sound immediately announce the point at which it has arrived. With the other hand he turns a screw, which causes another thread to pass horizontally across

the star; so that, intersected by all these bars, it is like a bird of light caught in a cage. But the star does not long remain entrapped, and hurrying to escape, vanishes twinkling as it came. The observer then relinquishes his gaze through the eye-piece of the telescope, and, first having perused certain hieroglyphic characters engraved on a part of the instrument, he comes down from his position to consult the results marked by the micrometers, and thus measure the angle of the distances.

The assistants are all astronomers by profession; and their eyes have been well trained by continual practice. How, then, can it happen that their observations do not always prove accordant one with another? There is a physiological mystery hidden in the fact into which it would be interesting to penetrate. Each observer, although operating with the same instrument and guided by the same plan, perceives a celestial phenomenon—as, for instance, the transit of a star—either sooner or later than another one does. This variation is attributed to the idiosyncrasy of the sense of sight in each individual, or to the more or less prompt manner in which the eye telegraphs its impression to the brain. It must, of course, be quite understood that no considerable inequalities of time are in question here; it is, at the most, some fractions of a second that I am alluding to; but the astronomical transit observations are of so delicate a nature that the slightest

errors would destroy their worth. Under these circumstances, it has been found necessary to establish an average or *standard*, and each observer gets to know precisely how far his visual faculties vary from this ideal. Hence arises a question, incomprehensible to the uninitiated, which, however, is commonly asked among the astronomers themselves, "What is the value of your personal equation?" This inquiry is answered by a figure expressing the particular amount of deviation from the standard. The most singular thing is, that the value of this personal equation is different in the same individual as regards the various celestial bodies; some can very quickly discern the phenomena of a fixed star who are much slower in perceiving those of the moon, and *vice versâ*. In order to obviate the inconvenience which might result from the variations in personal equations, they also have recourse to a very ingenious plan: an eye-piece with two tubes allows two assistants simultaneously to observe the passage of the same star over the same threads in the instrument; they both listen to the ticking of the clock marking the seconds, and separately calculate the results of their observation, which are afterwards compared. To obtain a greater degree of certitude, they occasionally exchange places. In this way the slightest chances of error are eliminated.

The aberrations of the instrument must also be taken into account. Notwithstanding its excellence and the

solidity with which it is fixed to stone walls sunk into the ground, it sometimes is affected by slight vibrations, which can only be attributed to the *terra firma* on which it is constructed. Mr. Airy has noticed this same phenomenon at Cambridge, whence he has come to the conclusion "that the surface of the earth, commonly regarded as the base of all solidity, is itself in movement." If we now reflect how much care and how many calculations these researches exact in order to rectify the least inaccuracies, and to discriminate the smallest particles of time, we shall easily understand how it is that this practical branch of astronomy can only be cultivated in a national establishment, and in certain respects even in only one observatory in the world.

In front of the telescope, and in the same room in which the great transit-circle stands, there is a clock which well deserves to attract our attention; it is regulated every day by observations of the stars at the moment of their passage behind the threads in the instrument. This it is which measures the time authoritatively in the institution at Greenwich. But we must take care how we consult it if we wish to set our watches to the right time; it would mislead us, although it derives its inspiration direct from the heavens. The time which it marks is the *sidereal*, and not the *solar*, time; and there is often a variation of several minutes between the two. This clock, however, serves to guide

the observer who is appointed to note the transits of the celestial bodies.

A faculty which certain astronomers possess is most astonishing; it is the power of an instinctive or automatic measure. Before applying his eye to the telescope, the assistant looks at the dial of the transit-clock, and listens for an instant or two so as thoroughly to catch the time of the beating of the seconds. Having thus worked himself up to the rhythm of the strokes, he continues to be able to mark, by a sort of internal movement, the least fractions of the time which succeeds. From this moment forward he is himself an animated clock. But the observer must take good care not to devote the whole of his attention to this measurement of the time, for he has need of the largest portion of his powers in order to note and dissect the various phenomena of the passage of the stars. As his visual faculties and his mind must be occupied with these latter objects, he must count the seconds, and even the fractions of seconds, by a sort of mechanical instinct, and in no way by any intellectual action. This faculty is an acquired one, and in some persons is quickly enough developed by practice; but, if an individual does not possess the germ of it, he will never be able to make himself a practical astronomer.

The observer who operates during the night with the transit-circle is often commissioned to notice celestial objects calling for the most painstaking atten-

tion. First, there is the moon, and some stars which are to be found in the neighbourhood of this luminary; next come some of the planets in an order which is, of course, changed according to the day of the year; then certain fixed stars which are not irrelevant to the art of navigation and to the division of time. These celestial bodies have at least the advantage of being easily seen; but this capability does not at all hold good when he has to deal with the numerous asteroids revolving round the sun in orbits situated between those of Mars and Jupiter. These pigmies of the solar system are often so difficult to be discovered, even with the assistance of the best telescopes, that, some minutes before their passage over his field of view, the observer has to lower the light of the gas-jets in his room. Well, in spite of every precaution, these glimmering points of precarious luminosity will occasionally escape the sight, armed though it be with the most powerful of instruments. Such is the minute and almost painful character of the researches, the labour of which the Observatory at Greenwich has latterly agreed to share with that of Paris. From the new moon to the full moon all the small planets are inspected at Greenwich, and from the full moon again to the new moon they are watched at Paris. The *ephemerides* are afterwards reciprocally interchanged between Mr. Airy and M. Leverrier. This mutual change of duties has somewhat alleviated the burden of astronomical labours in

both countries; but, nevertheless, their task is a hard one. It is sometimes necessary to watch the starry vault for ten or eleven hours in succession through some of the fine winter nights. These fine nights, though, are frosty; the sky, transparent as a slab of crystal, is all open over the head of the observer, and the sidereal light may help to illuminate, but it cannot warm. It would be of no use to light a fire in a place which differs but little from the open air. The assistant enters the park-gates, of which he is provided with a key, in the gloom of the wintry sunset, and leaves again, happy at his release, though benumbed with cold, before the rising of the sun has blotted out the other luminaries in the brightness of the day.

What, however, is the aim of all these observations? It is to determine, at a given moment, the exact position in the sky of the planets and principal fixed stars which are visible in the latitude of Greenwich. These authentic indications furnish the means of rectifying the errors which have somehow or other crept into other ancient and modern works of science; at the same time, they provide the means necessary for the publication of the "Nautical Almanack." This astronomical guide for mariners is printed three or four years in advance, for the benefit of those who undertake long voyages at sea. The volume for 1868 had already appeared at so early a date as 1865.* Those books predict

* Since 1862 the Lunar Tables for this Almanack have been drawn

for each day the positions of the moon and the planets, as well as all the celestial phenomena that can be of interest in navigating a vessel. It is, in fact, to Greenwich Observatory that the mariner looks for information sufficient to enable him to ascertain his position at sea, the bearings of the points he has to touch at, and of the rocks and shoals he must avoid in the course of his voyage. The astronomer watching the celestial movements on the little hill in the park stretches out over the immensity of the ocean a helping hand to the sailor wandering from his course on the great watery waste, and, as it were, compels the stars to lead him safe to his port. But how can this be the case, and what are the means adopted for finding out the longitude at sea?

Let us imagine a vessel at the mercy of the wind at night-time, and near rocks or sandbanks which are supposed to be still far distant. The sky is clouded with gloom, and the pilot has, in fact, lost his way. Suddenly a clear spot breaking between the clouds allows a group of stars and the moon to become visible. The navigator at once consults his "Nautical Almanack," and then, with the help of instruments and calculations familiar to mariners, he is not long in discovering, by the situation of the stars, what time it is

up according to the plan of M. Hansen, a celebrated professor at Gotha, who has interpreted by profound calculations the mass of facts collected at Greenwich Observatory.

at the spot where his vessel then lies. Next, by comparing this time with that of his chronometer—regulated before his departure by the clock at Greenwich—he easily ascertains his longitude. It is a well-known fact that in these cases the difference in time gives, by a simple rule, the difference in distance. Confidence is at once restored to the hearts of the sailors, for they now know where they are, and foreseeing its snares, can sail fearlessly over the deep.

Of all the heavenly bodies with which navigation is concerned, the moon is, undoubtedly, the most important. It is, therefore, for her inspection principally that Greenwich Observatory has been founded. For many years this establishment has made itself famous by its studies of our satellite. Up to 1814 it was applied to for every information relative to the practical survey of the heavens. Since the above time the German astronomers have availed themselves of the observations of the sun made at Königsberg; but those of the moon made at Greenwich defy, and doubtless will long defy, all rivalry. This superiority is of such extent, that the French Minister of Marine writes from time to time to the Astronomer Royal at Greenwich to obtain the lunar tables of that establishment, which are, in fact, an authority over all Europe. And yet, in 1840, Mr. Airy was struck with a grave imperfection in the means then known for surveying this luminary. For instance, the observations obtained by the help of

the transit-circle could never take place during a period either four days before, or four days after, the new moon, because this body is then found to be too near the sun. It also very often happened, in the damp climate of England, that clouds obscured the face of our satellite just as it was entering the line of the meridian. Under this state of things they could observe but imperfectly a portion of the moon's course, and a quarter of it became entirely lost. It was in order to remedy this inconvenience that the *altazimuth* was invented.* Thanks to this movable apparatus, which follows the moon into every part of the sky, instead of waiting for her on one given spot, there is scarcely a night, however cloudy it may be, when this luminary is to be found above the horizon, that she is not occasionally visible to the astronomer on duty. In this way the field of their researches has been much extended. Before 1847, the date when the new instrument was erected, they were scarcely ever able to obtain more than a hundred lunar observations a year at the establishment at Greenwich; these now amount to more than 212. The results acquired by the help of the altazimuth are afterwards compared with those given by the transit-circle; and by means

* This instrument is intended, as its name implies, to attest two kinds of phenomena, the *altitude* and the *azimuth*. By the *altitude* we must understand the *angle of elevation* of a star; by the *azimuth*, the arc of the horizon between the meridian of the place and a vertical line passing through the object observed.

of these double observations, made on, as well as outside, the meridian, they have been enabled to arrive at a degree of certitude hitherto unknown in other astronomical establishments.

To reach this instrument, the *altazimuth*, we have to go up a narrow staircase, winding round a brick pillar shut in with masonry. This column, rising from the ground almost to the top story, supports a large cylindrical block of stone to serve as a pedestal, and is, as it were, isolated in the midst of the building. From this form of construction it would be useless to tread with heavy step round the instrument—you could never succeed in shaking it; supported as it is on a firm base of its own, it is independent of the floor of the room in which it stands. All these delicate precautions are necessary to insure the success of astronomical observations. The altazimuth is not unlike a great bell cast in one run of metal, in the centre of which a telescope has been inserted. If seen during the day it appears an inert mass, but what a change takes place at night! These astronomical implements are something in the same case as the nocturnal birds of prey; they are torpid in the sunlight, and awake only as the shades of night approach. Then everything round this instrument seems to wake up. The chamber where it reposes is covered with a wooden ceiling constructed in the form of a dome, which itself can be put in movement by the impulse of

the hand. This revolving cupola has in it an aperture, which is closed up during the day by shutters that can be opened at will, and by turning this opening in front of the object-glass of the telescope, the observer can select the quarter of the heavens that best suits him. The moon still continues hidden when the observer commences his watch, and he points the telescope, flanked by the two wings of the heavy machine, to the point of the horizon at which he expects to catch a glance of her. Although weighing nearly a ton, this mass obeys like a faithful servant the hand of him who knows how to deal with it, and it seems, as it were, to live by the breath of his will. The luminary appears; it is immediately saluted by the tapping noise we have already listened to in the other room in the Observatory. The clicking of the ivory key is repeated every time that the moon passes behind one of the twelve threads that are fastened across in the telescopic field of view, six vertically and six horizontally. One observation ended, another begins; the instrument is then altered and reset; to which process it yields with the submission of an elephant picking up a needle with the end of its trunk.

The duty connected with the altazimuth is among those which are most dreaded by the assistants at Greenwich during the dark nights of November, which are sleepless nights for them. They are exposed during many hours to the irritating gusts of the west wind,

and meet, full in their eyes, the depressing light of the moon—of all lights the most fatiguing to the sight. And yet Phœbe is decidedly the favourite at the Observatory: when several objects at once contend for the attention of the Greenwich astronomers, she always obtains the preference. It has been a custom in the establishment, since time immemorial, to suspend on Sundays their celestial observations. On this day the heavenly bodies are allowed to have a holiday, but there is one solitary exception, and that is the moon. The Argus-eyes that watch *her* know no repose, either by night or day, during the whole year.* She is talked of very much as if she were a real person; she has an *age* and a *face*, she is *young* or *old* according to the number of days which have elapsed since her birth.

And yet we must not deceive ourselves; these observations obtained by the help of the altazimuth, like those made with the transit-circle, have very little of the poetical element about them. What is it, in fact, that they are intended to determine? To fix the exact moment when any given celestial body appears at a certain point in the heavens, and when it disappears.

* The English—men of business even in scientific matters—love to express in figures and amounts of money the importance they attach to the verification of certain celestial phenomena. The observations of the moon are entered as £1,000; that is, about one-third of the whole annual expense of the establishment. Each complete observation is valued at about £10.

In this respect, the observer at Greenwich treats the matters of the starry world a little like a London trader marking down in his books his "comings in" and "goings out." It is certainly necessary that these labours should be undertaken; the more troublesome and exacting they are, the more reason there is for admiring the indefatigable patience of those who have the courage to carry them out. This branch of astronomy, too, is the one which is least flattering to the imagination. The observer must strictly exclude all feeling of sentiment at the sight of the sublime phenomena of the heavens, and must fix a cool eye on the starry regions of space, at the silence of which Blaise Pascal was afraid. At least for the moment he has nothing to do with the order and constitution of the vast luminous orbs which are gliding along over his head. Their position and the time which they indicate, these are the only points he has to look to. If, however, we feel any anxiety to open out some of the vaster and more mysterious prospects in the heavens, we must betake ourselves to the room where stands the *great equatorial.*

This instrument, fixed in the new south-eastern dome, is certainly the one which at first sight most excites the surprise and admiration of strangers. The amphitheatre-like steps which surround it with a circle of fine woodwork, the movable ceiling, the iron-work supporting the telescope, all here breathes a sentiment

of majesty and grandeur. The lens of the telescope, measuring 12¾ feet in diameter, cost by itself £1,200.

This instrument, erected about 1859, is provided with every necessary for making astronomical observations outside the meridian. Let us at once point out the chief characteristic which distinguishes it from the *transit-circle*. The great equatorial is not intended to welcome a star coming to visit it, so to speak, at a fixed time and place of rendezvous; its duty, on the contrary, is to pursue constellations wandering in the depths of the firmament. In order to do this it is requisite that it should move—itself and all its surroundings—towards every possible quarter of the sky. There is nothing about it, down to the very chair of the astronomer, which cannot be elevated, depressed, and turned; and it adjusts itself, as it were spontaneously, to the nature of the observations. As to the roof, it is necessary for this too to follow the round of the stars. It is made of wood, covered with zinc on the outside, and lined internally with thin sheet-iron; it revolves on cannon-balls placed at intervals on the top of the circular wall which supports it. This can be at will opened, and almost taken to pieces, by means of movable shutters. When they wish to change the point of view, an iron-toothed wheel is made to revolve, the roof is soon put in motion, and stops when the opening stands directly opposite the observer.

But yet this is not all; in order to scrutinise atten-

tively the mysteries of the heavens, it is necessary that the object contemplated should remain for some time visible in the same position. But how can this be managed, since the earth, by accomplishing every day its actual movement of rotation, communicates an apparent motion to the stars? Whoever has looked through a fixed telescope knows in fact how quickly the celestial bodies steal out of view. To obviate this inconvenience, it has been found requisite to animate the instrument with an action exactly in conformity with the planetary mechanism, for one movement destroys the effect of another exactly equivalent to it. A kind of water-clock, which stands in a room beneath that of the *great equatorial*, is appointed for this purpose, and suffices to keep in motion the massive apparatus above. One single fact will serve to show with what success its delicate functions are fulfilled. One night the telescope had been left at the moment when Jupiter showed itself close to the central thread; the assistant, called away by other duties, returned at the end of an hour, and found the planet again at the exact point at which he had left it. The inexorable instrument had not let go its prey.

The *great equatorial* is made use of to examine the stars, the eclipses of the sun, comets, and many other celestial phenomena. This telescope alone can satisfy our just curiosity in all that concerns the visible form of the worlds revolving over our heads. If, for in-

stance, we examine the moon, which is always the more interesting as it is the nearest of these bodies to our terrestrial globe, its uneven and rugged surface appears through the instrument as if marked with zones and luminous tracks interspersed with black spots. These illuminated portions, we have every reason to believe, are the summits of very lofty mountains lighted up by the rays of the sun. The black patches, on the contrary, are the dark shades thrown by the masses of these lunar Alps and Andes. Even in the obscure bands, however, there glitter at intervals some luminous points. An attempt has been made to explain these alternations of light and shade by a comparison with what occurs on our own sphere. Any traveller who has explored the districts of Wales or Scotland must have noticed somewhat similar effects. In the evening, at a moment when the valleys and the bases of the mountains are already buried in obscurity, the rays of the setting sun will still continue to lay hold of the projections and crests of the peaks rising at intervals as if in emulation of one another. The moon, too, has mountains; she also has volcanoes, which can be distinguished by their circular form. The latter are so easily to be recognised that names have been given them, and astronomers have gone even further than this—they have measured them. There is, for instance, the extinct crater of Tycho; it is, I am assured, forty-seven miles in extent. The escarp-

ments, the cliffs, and the external mountain chains which surround it are elevated three miles above the plain shut in by this serrated boundary of hills, on which also a kind of central rampart rises more than a mile in height. One is thus able to form some idea of the physical organisation of the moon, and also of the boldness of human intellect, which, not content with exploring the earth, seeks to penetrate the mysteries of other worlds. By the aid of very powerful telescopes they go so far as to distinguish the various strata of the rocks composing the mouths of the volcanic caverns. One step in advance in the construction of instruments, and perhaps some day the *savants* will be in a position to form a geological system for the moon. As far as they have hitherto gone, however, there are no certain signs of vegetation; it is an arid mass, a surface of a kind of pumice-stone, bristling with mountains, and intersected with abysses—an inanimate world, or, perhaps, a world on the point of springing into life. The time of the full moon is the most favourable moment for observing this luminary, and yet when its youthful crescent glides into the heavens, sharp and bright as the sickle of the reaper, it is then also a very interesting object to survey through the telescope. One then sees the whole circle of the moon, but its crescent alone is illuminated, and the remaining portion of its pale disc is but faintly sketched out in a kind of *penumbra*, or half-shade.*

* It is an effect, it is said, of the reflected light of the earth.

The assistants are besides directed occasionally to observe, and even to delineate, the figures of the planets just as they appear through the telescope. Sometimes it is Venus, surpassing all the rest in lustre, in which an atmosphere has been discovered as well as lofty mountains. At other times their attention is claimed by Jupiter, accompanied by his four moons, with their continual diversity of movement. His broad disc is of a yellowish colour, blending towards the poles into a lead-coloured grey. Over the face of this planet dark belts appear to extend, somewhat resembling in form the streaks which are occasionally stretched across the sky on a fine summer's evening. These belts are of a greyish brown in hue, and are at times coloured with a red tint. They sometimes, from day to day, undergo visible changes, and these and other circumstances have led to the belief that they were indeed the clouds of another world. Spots are also observed, sometimes bright and sometimes dark, the movement of which has brought to the knowledge of astronomers both the rotation of this planet from west to east, and the space of time it takes to revolve upon its axis. It is thus known that the inhabitants of Jupiter (if indeed any exist) enjoy a day made up of a little less than eleven hours. These spots, forming and vanishing as they do, appear to be themselves clouds carried swiftly by the wind in an agitated atmosphere. But why should a globe so corresponding

to our own in respect to certain meteorological phenomena, and also the largest of all those belonging to the solar system, be nothing but a mere solitude? English astronomers are not in general reluctant to admit the idea of the plurality of worlds; they only maintain, and correctly so, that if life is developed in other spheres, the conditions under which we meet with it here below must be entirely modified.

After Jupiter, Saturn is one of the planets which most interests the curious. Round a ball of a light orange colour, and intersected, like its brother planet, with flat belts, are seen two, if not three, rings illuminated like the globe within them, and another ring which is but obscure or semi-transparent. Of the eight moons which attend the planet, four only are visible; the others more or less evade our means of observation; but, even without these, what a magnificent spectacle is presented! What a bright optical vision is the vista of the night! What description, too, can be given of those stars which, looked at with the naked eye, seem to be but one, but resolved into their elements by the telescope, break up, each one sometimes into a hundred distinct, but doubtless far-separated, bodies? One might compare it to a diamond dashed to pieces in the interior of a telescope, and flying away in fragments like a dust of stars.

These wonders of the firmament, however, are the very things of which the least notice is taken in

Greenwich Observatory. The Astronomer would consider as a baneful luxury any instrument, or any kind of research, which was not strictly subordinated to the great aim of the institution. Thus, whilst the Transit-circle Room, and the dome of the altazimuth, lighted up every night, show that work is going on in them, the tower of the great equatorial remains most often dark and deserted. This noble instrument is only made use of on certain occasions, so as not to absolutely neglect any branch of astronomy.

Be this as it may, whenever the great equatorial is being operated with we hear the repetition, under the finger of the observer, of the same *tick-tick* noise which has before puzzled us in the other departments. To find out an explanation for this music of the stars—very different from that dreamt of by Pythagoras—we must go down into a little room opening under the north dome. We shall there see an instrument called the *chronographic recording apparatus*, which is, in fact, intended to record the time as well as the transit of the celestial bodies. This apparatus is composed of two very distinct parts—a kind of clock of an altogether peculiar construction, and a roller known under the name of the *American barrel*, revolving in a glass case. The clock, actuated by an entirely uniform movement, is the work of Mr. Dent, the celebrated English mechanician. The *barrel* is a cylinder of copper covered with a piece of cloth, on which is

stretched a sheet of white paper, rolled round and fastened with gum at the two ends. The clock gives motion to the roller, and at the same time agitates a travelling-rod armed with a double system of points. One of these points marks the seconds, and by means of galvanic wires is placed in communication with the transit-clock, which is itself regulated by celestial mechanism. The other point marks the transit of the stars, and by another magnetic wire is placed in connection with the ivory keys fixed near the eye-pieces of the large telescopes in the other rooms and departments of the Observatory. The transit-circle, the altazimuth, and the equatorial communicate in this way with the chronograph, and a ticket points out the instruments that are at work at any given time.

It will now be easy for us to understand the meaning of the noises we have heard elsewhere. A simple pressure of the finger and an electric current, though at a distance from it, immediately sets in motion one of the teeth of the chronograph, and the tooth, like a serpent's fang, at once punctures with a sort of bite the revolving roll of paper. When I inspected this apparatus it was ten o'clock in the morning, and the white sheet of paper rolled round the barrel was already completely covered with the night's work. Small holes were traced out all over it at intervals, very like those that might have been made with the point of a pin; each of these slight punctures represented the

transit of a star or of a planet which the observer had, as it were, pricked off flying. One then removes from the barrel this hieroglyphic page of the celestial history, written down, as it is, night by night, by the means of the instrument, and it is made over to assistants to be reduced by calculations. By the help of these materials, and of this celestial journal—if we may so call it—a large volume is published every year containing observations on the sun, the moon, and all the moving bodies of the solar system.*

The nature of the instruments, the choice of the stars surveyed, the character of the problems resolved, all sufficiently show us that Greenwich Observatory has the interests of navigation as its principal object. Must not the same class of studies naturally extend itself to physical geography? It is from the heavens that we have learnt to measure the earth. In every age they have had recourse to the observation of the stars in order to discover the dimensions and shape of our globe, the elevations and depressions of its surface, as well as the distance between one point and another on it. Thanks to previous labours, we are, at the present day, well acquainted with all these facts; but it is necessary, from time to time, to recommence these experimental surveys, so as to do away with the slightest chance of error. These old geodetical divisions were, besides, traced out in an age when science

* "Observations of the Royal Observatory, Greenwich."

had not yet availed herself of all the mechanical agents which at the present day she has pressed into her service. Struck with the latter advantage, and quite resolved to derive what benefit he could from it, the Astronomer Royal, about 1853, entered into arrangements with M. Quételet to determine the difference of longitude between the Observatory at Greenwich and that at Brussels. This operation, conducted by the *savants* of both countries, was crowned with a real success.

About the same date similar negotiations were opened between two other observatories, and the last letter written on the subject by Mr. Airy arrived in Paris the very day of the death of M. Arago. The arrangements were renewed with his successor, M. Leverrier, and with his furtherance the labours commenced. Their course was now much smoothed, for Greenwich Observatory had before this been placed in connection with that of Paris by a system of telegraphic wires. The messages travelled from one to the other, having crossed the Channel through a cable stretching under the water between the South Foreland in England and Sangatte in France. They did not fail to avail themselves of these advantages in organising the management of this new astronomical inquiry. As the matter stood, M. Fay was sent to England as the representative of M. Leverrier, and Mr. Dunkin left England to act in the same capacity

for Mr. Airy. Each of these gentlemen had to conduct simultaneously the first series of operations in all the points relating to the instruments, the passage of the stars, and the electric signals. This being done, the French observer returned to Paris, and the English observer came back to London to direct the second half of the experiments. This interchange of station, and this alternation in the employment of the powers of two astronomers, strangers to each other, have been considered necessary in all researches of this kind, so as to remove even the shadow of mistake. Their mutual labours were not without practical result. The data obtained by these last celestial statistics show that the difference in longitude between the Observatories at Greenwich and Paris is 9° 20′ 63″. This is almost a second less than the difference ascertained in 1825 by Sir John Herschel and Colonel Sabine. Having at command no electric wires (which were then unknown), the two latter astronomers made use of fusees for the purpose of giving signals. In the more recent researches, the two observers, during the eighteen days which elapsed from the beginning to the end of the operations, exchanged mutually 2,530 telegraphic signals.

A similar course of procedure was employed in 1863 to measure the longitude between Greenwich and Valentia, an islet on the coast of Ireland, which is every day pushing itself into greater importance in

consequence of its communications with the continent of North America. On this occasion the difficulties were enormous. It became necessary to organise beforehand, in conjunction with the respective companies to whom the great telegraphic lines belonged, a complete system of messages which should have all the speed of lightning. Messrs. Dunkin and Creswick repaired to the spot in order to make the necessary arrangements and to observe the heavens. Everything succeeded wonderfully, and in spite of a distance of 800 miles (taking into account the necessary *détours* of the galvanic wires), every star passing a given line at Valentia was immediately registered on the chronograph at Greenwich. One single movement of the finger sufficed for this. No doubt, in the course of time, similar experiments will be extended over the whole world, until the entire surface of the earth shall be exactly measured. Why should not the cable, which has now for some months been quivering with the electic current at the bottom of the Atlantic, serve some day to telegraph from one hemisphere to the other the whole detail of the celestial movements, and thus write an authentic history both of time and distance?*

Another very curious application of astronomy is

* New York being situated at about 74° 40′ longitude west of London, it is about five o'clock in the morning in the chief city of the United States when it is ten o'clock in the capital of England.

that which was put in practice about 1844; this time no longer for the purpose merely of determining the position of one given locality with regard to another, but in order to divide territories almost entirely unknown to travellers. Between Canada and the northern portion of the United States of America there lies an impenetrable region, where dark virgin forests, deep ravines, and dismal marshes have long defied the efforts of the two Governments and all the appliances of geodetical science. On account of all these obstacles the boundaries of the two countries had not been definitely fixed in these regions. In 1843 Lord Canning wrote to the Astronomer Royal to call his attention to the subject, and Mr. Airy advised him to send to the spot some military engineers, to whom he, Mr. Airy, would previously give some useful instructions. In consequence of this advice, some officers of the above corps repaired to Greenwich, whence, after certain preliminary studies, they left for Canada. Two groups of observers, each party being furnished with a telescope, a chronometer, and some other instruments, placed themselves at the two lateral extremities of the wild country which it was their business to divide. By means of calculations, dictated in a great measure by the movements of the celestial orbs, they traced out a boundary-line in conformity with the nature of the treaties which had been signed between England and the United States. The two parties being placed at a great distance from

each other, they had no means whatever of coming to any understanding as to the progress of the operations. The studies and calculations being terminated, one of the two groups of engineers advanced slowly through the forest, cutting out a path in a straight line in the direction previously arranged, which they followed on the credit, as it were, of the stars. How great was the astonishment and joy of these gallant geometricians when, having cut their way through forty-two miles of brushwood and trees, they perceived from the summit of a hill the goal they had been aiming at! Right in front of them, on another eminence not very far off, they caught sight of a gap cut in the dense and sombre curtain of the woods. This gap became more and more extensive, and soon disclosed to view the other body of engineers approaching from the opposite side of the district. The two lines thus met end to end; the difference between them did not exceed 340 feet, and this very slight deviation was owing to an error of only one second in the difference of longitude. England and the Government at Washington hastened to recognise as the boundary of the two states this line marked out by the authority of the heavens.

Greenwich Observatory, as we see, neglects no opportunity of bringing the stars and their movements into relation with the affairs of political and civil life; but, first and foremost, it requires from the celestial orbs some means for measuring the time of day. It seems a very

simple thing now-a-days to know what time it is, thanks to the progress in the art of horology, and there are many persons who have but little suspicion of the trouble it costs to arrive at such a pitch of accuracy. We must, however, certainly confess that our watches, and even our best time-pieces, would not be very long before they were all running wild if we did not possess the means of occasionally calling them to order. We generally regulate them by some official clock; but even these often themselves need to be controlled by some authority superior to that of the mechanician's art. Where, then, are we to look for the true prototype of the "right time?" One of the principal functions of the Astronomer Royal is to furnish this *standard* of time, and his task most certainly is not a very easy one. He must, in a manner, seek for the right time in the heavens, and when he has brought it down to earth he must multiply and circulate the indications of it by means of instruments the precision of which shall leave nothing to be desired. This branch of science—horology—is cultivated with extreme care at Greenwich Observatory, and well deserves that we should dwell a little on it.

CHAPTER III.

WAY IN WHICH ASTRONOMERS RECKON THE TIME—HOW THE CHIEF CLOCK AT GREENWICH IS REGULATED — DIFFERENCE BETWEEN SIDEREAL AND SOLAR TIME—THE TIME-BALL—THE TOWER AT DEAL—LOCAL TIME AND RAILWAY TIME—ELECTRIC AND INTERNATIONAL TELEGRAPH—SPEAKING CLOCKS—THE CHRONOMETER ROOM—MAGNETIC AND METEOROLOGICAL OBSERVATORY — JOURNAL OF THE ELEMENTS WRITTEN BY THEMSELVES—THE OBSERVATORY THREATENED BY RAILWAYS—PRACTICAL AND THEORETICAL ASTRONOMY—UTILITY OF GREENWICH OBSERVATORY IN A NAUTICAL POINT OF VIEW.

"I AM going to show you the clock which sets the time for the whole of England," said the Astronomer Royal to me in rather a solemn tone, as he conducted me into a little room, occupying (by the side of the chronograph) one of the oldest parts of the edifice. But we must not expect to see an object of any superfluous beauty. Covered with its simple mahogany case, this *mother-clock*, as it is called, is not unlike one of those venerable wooden-cased clocks that one meets with sometimes in the old English manor-houses. No one, however, could fail to discover that the mechanism in this time-keeper is new and uncommon. Its chief characteristic is that it possesses two distinct attributes: in

the first place, it marks the time most exactly; and in the next, it communicates this power to other clocks as well. It has, therefore, been also designated the *motor-clock*, because it animates in the Observatory eight of its *daughters*. Its dial is divided into three circles, one of which marks the hours, another the minutes, and a third the seconds. One needle only, or hand, as the English call it, moves round each of these dials, and thus points out the generally accepted measures of time. There is, however, something peculiar in the manner in which the number of the hours is marked.

As regards this point, astronomers do not reckon at all in the same way as we do; in their view, a day embraces the whole duration of a revolution of the earth on its own axis; it is, as La Place well observes, "the period of time comprised between two consecutive noons or midnights." Whilst, therefore, the dials of our clocks contain *twelve* hours only, *twenty-four* hours are inscribed on the faces of the astronomical time-keepers. This arrangement is a frequent puzzle to persons ignorant of science, and to a great many these signs are nothing but an enigma. For instance, what can be meant by *half-past fifteen o'clock*, or *ten minutes past twenty?** What does the sign 0·36 *seconds* stand for? The cipher 0, which takes the place of the figure XII. on other dials, is the starting-point from which astronomers reckon the hours in succession up to the

* Half-past three, and ten minutes past eight in the morning.

beginning of the next day.* This curious way of reckoning the time by no means prevents the clock at Greenwich from being consulted by all the other clocks in the kingdom.

If it thus sets the fashion for all the other clocks, and rectifies all their errors, it is highly necessary it should be provided with the means for self-reformation. Its errors, I must confess, are very trivial; this clock in any considerable space of time varies but some fractions of a second; but still, like every other work proceeding from the hand of man, it needs to be occasionally regulated. It is regulated by acting on the pendulum: just in measure as the latter is shortened or lengthened by a very simple magnetic apparatus, the movement is made faster or slower. This method of dealing with it is not, however, carried out in the room where the clock stands; it is managed from a distance, and without ever being touched with a finger. Let us suppose for an instant that the walls are of glass, and then let us notice what is going on in another room in the Observatory.

A clerk who performs the functions of superintendent of the time is seated before his desk in the computing-room, situated on the ground floor, near the study of the Astronomer Royal. He has just in front of him and attentively examines two small clocks about as

* It would mean thirty-six seconds past twelve at noon.

large as a marine chronometer. One represents the *transit-clock*, the other is a reproduction in miniature of the one we have just inspected—the *motor-clock*. The first marks the hour of the sidereal, the other of the solar day.

We must, however, in the first place, explain the difference between these two systems of the measurement of time. The sidereal day is shorter by four minutes than the solar day; in the course of the year this makes up a difference of twenty-four hours, and a calculation is naturally needed to convert this estimation of time into that which is sanctioned by general use. The other clock—the motor-clock—on the contrary, shows the progress of the solar day; that, in fact, which our watches and time-pieces are meant to tell us. To this the astronomers have given the denomination of the *mean time*. In order to understand this term, which is so often met with in the journals of maritime officers, we must recognise that our solar day is itself based on a mere conventional arrangement. The earth revolving round the sun in a somewhat oblique movement, the latter does not make its appearance every day on the meridian of the same place at exactly the same time. Every one must see how highly inconvenient it would be in all the business of life if we had to take account of all the irregularities of this luminary. They have, therefore, settled to adopt a day of uniform length, founded on certain astronomical

principles, and it is this adopted day—a sort of average of all the days of the year—which has given rise to the division of time marked by our chronometers.

But what is it which the clerk, or time-superintendent, has to do? He compares the results of the two small clocks placed above his desk, each of which communicates with its prototype through the medium of wires and the electric current. The first gives him the time by the stars—the unerring time—and thus furnishes him with the necessary criterion for correcting the errors of the second, if there is any occasion for it. By means of the handle of a regulator, which he can turn at will though a long distance away from it, he can increase or diminish the length of the pendulum of the principal solar-clock, and he thus modifies, not only the motion of the latter instrument, but the whole horological system of the Observatory. The other time-indicators are, in fact, depending on this *motor*, and they follow all its pulsations; they are only, as it were, repetitions of it. The only one among the accordant clocks at Greenwich which is known to the public is that which is to be seen in the park, close to the door of the Observatory. At this spot, almost every minute in the day, people stop and gravely regulate their watches in front of a wooden dial on which two great hands revolve with a kind of spasmodic movement. Many of them have but little idea that what they are looking at is but a repetition of a central mechanism

that is not visible at all to them. It is but the *motor-clock* reproduced in a second self.

Greenwich Park, on a fine afternoon, is pretty well thronged with a crowd of inquisitive people, whose eyes are all turned upwards towards a great black ball fixed on the eastern tower of the Observatory. Five minutes before one o'clock this time-ball slowly ascends to the top of a mast or pole, and at one precisely it descends. What is then going on inside the building? The *ascending* movement is given to the ball by means of a chain and wheel turned by a servant in a passage on the ground floor. When this is accomplished, the hand of man has nothing more to do with the rest of the arrangements; the movements of the motor-clock complete the proceedings. At one o'clock precisely one of the galvanic springs with which this time-keeper is so plentifully supplied flies apart with some violence, as if it would break, and the sound of the massive ball sinking down on the roof is immediately heard.

The promenaders in the park are not the only persons who follow eagerly with their eyes the fall of the ball; the crews of all the vessels lying at anchor in the Thames or filling the various docks are also interested, but in quite another way, in watching these telegraphic movements. The mariners are thus placed in a position to compare the precise Greenwich time with that of their chronometers, which, when they are well regulated, will subsequently enable them to dis-

cover the longitude when at sea. If one reflects how much the art of navigation depends on the knowledge of the exact time, the utility of these time-signals will be appreciated as it ought to be. The Astronomer Royal has, therefore, considered it but right to place more of them on the English coasts.

At Deal, a small town situated on the shore of the channel, in the midst of the sand-banks and the downs, there is an old tower which now belongs to Greenwich Observatory. In this tower, which has been repaired and surrounded with an enclosure, an official resides who is called the *ball-attendant.* Nevertheless, he has nothing to do with the arrangement of the time-signals: this is still the business of the motor-clock. An electric current flashes from Greenwich, and, at a distance of at least seventy miles, causes the ball at Deal to descend at precisely the same moment as that at the Observatory.* There is, perhaps, scarcely a place in the world where a signal of this sort could render more service, for the portion of the straits commanded by this tower is a kind of highway in which ships are continually passing to and fro, crossing and re-crossing one another's course. The Astronomer Royal has for some time past had the idea of establishing two of these horometrical watch-towers at Portsmouth and Devonport, the latter the port for Plymouth. In the mean-

* The ball at Deal not only yields to this distant impulse, but it also, by a reverse current, informs Greenwich that it has obeyed.

time, automatic balls, constructed after the same plan, and moved by the same influence, are lowered every day, at one o'clock precisely, in the Strand, in Cornhill, and in Liverpool. At Newcastle and Shields, Greenwich Observatory fires a cannon, still by virtue of the magnetic powers issuing from the *mother-clock*. At the moment of firing a train of carriages darts out on the railway line.

In this age of business, steam, and bustle, among a people who have taken for their motto the proverb, "Time is money," it is not difficult to recognise the importance that is attached to the public notification of the true time. When positive astronomy had succeeded in perfecting so many bonds of union with nautical matters, it could not long remain estranged from the interests of public life. And yet the striking of the public clocks in England up to this day presented a considerable resemblance to the confusion of tongues. The Tower of Babel seemed to be changed into a multitude of old steeples, whose voices all desired to tell the same tale with a total absence of any mutual accord. I would not take upon myself to say that even at the present time there may not be found, in some old towns, many partisans of the *local time*, who look with a jealous and uneasy eye at the general introduction of the system of unity in our hourly records. Be this as it may, this innovation has already, thanks to the railways, in a great measure achieved a triumph; and "railway

time," as it is called in England, is nothing more nor less than the time indicated at Greenwich. For instance, the *mother-clock* at the Observatory is every second sending to London Bridge Station an electric current, commissioned to set in motion and regulate the works of another clock belonging to the South Eastern Railway Company.

Another branch of the public service, which should claim, whether before or after the railways is difficult to say, the principal solicitude of the Astronomer Royal, is the General Post Office in St. Martin's-le-Grand. Here, also, the hours march on, conducted, as it were, by a wire coming from Greenwich. Four clocks thus identified with those at the Observatory regulate in their turn, also by local electric currents, a group of sisters, and thirty of them are thus found working in a harmony more or less perfect. It is one of the most beautiful mechanisms that exist.

Besides this, the Observatory transmits signals every hour to the office of the Electric and International Telegraph in Lothbury, whence, by a net-work of galvanic wires, the knowledge of the true time is spread along the lines of railway to almost the extremities of Great Britain. This vast Æolian harp covers thus with its chords nearly the whole surface of the British Isles, and vibrates in unison with one prime-mover. Some of these telegraphic signals, having passed through numberless *détours*, reach finally the

counting-houses of some of the great London merchants. This kind of nervous system, if we may so call it, finding its application in the dissemination of the true time, is doubtless destined to extend; it is, indeed, increased every day by fresh wires attached to, and branching out from, the old trunks. Why should not the day come when every inhabitant of London should have "Greenwich time" brought into his house, just the same as he now enjoys water and gas?

I was naturally curious to see the centre from which all these electric communications take their course. The Astronomer Royal conducted me to a trap-door and a ladder leading down into a double cavern or cellar. The first vault is occupied by galvanic batteries arranged upon planks. In the second, I saw, twisting, winding, and crossing one another over the walls and ceiling, a variety of good-sized iron wires, whose entanglements were not a bad representation of the coils of a serpent. These wires, the greater part of which communicate with certain instruments in the Observatory or with the motor-clock, traverse the ground in channels cut out for them, and make their way to the railway station at Greenwich, whence they subsequently radiate all over England and the Continent. Some years ago this telegraphic service was carried on in the open air; but on two occasions, in the winters of 1865 and 1866, a storm of snow, accompanied with frightful gusts of wind, destroyed the

wires and beat down the poles which carried them. In order to avoid the interruptions which were caused by these and similar accidents, a system of subterranean communications has been since then adopted.

As regards the true time, these telegraphic wires have a double mission; the current leaving Greenwich transmits the signal given by the clock at the Observatory, and what is called a return-current then communicates the errors of the other clock on which the *motor* has just acted. This reciprocating movement is necessary to the precision of the ruling system. "I would never undertake to regulate a clock from which I did not get regular replies," said the Astronomer Royal to me. And just as we were passing in front of a galvanic apparatus, "Stop," he added; "the great clock at Westminster is at this very moment giving me an account of itself; it goes well, and is only the twentieth part of a second slow. Twice a day in this way it keeps me informed of the state of its health." Can we doubt that this exact measurement of time does not in a great measure contribute to the development among our neighbours of that system of punctuality which is looked upon by them as the soul of business?

Not content with setting the time for the whole kingdom, Greenwich Observatory adds to its duties by undertaking the care of the instruments which have to point out this same time to navigators over all the

immensity of the ocean. I was conducted into a portion of the establishment which is called the Chronometer Room. These chronometers are mahogany boxes, inside which is contained the horological mechanism, one of the lids being raised so as better to inspect them. Harrison, a carpenter of Lincolnshire, who lived in 1774, was the inventor of chronometers. If well regulated, these nautical time-pieces will preserve an even rate of going, in spite of the movements of the vessel, and will constantly indicate the time as it is at Greenwich. This time being compared with that subquently ascertained by observations at sea, it becomes easy for the navigator to find the difference of longitudes during the whole course of his voyage.

What a buzzing noise is heard here, just like a swarm of bees! There are sometimes near upon two hundred chronometers or nautical watches collected in this room, all beating together. A concert like this, in which the musicians do not all perform in correct measure, indicates a kind of discord in the kingdom of time. And yet the greater part of these instruments are very perfect and delicate works of horology. From 1822 to 1836, a competitive trial of chronometers was held at Greenwich Observatory, and after a year's test prizes were awarded to the best of them. This arrangement, which was useful in many respects, and has no doubt contributed to bring this mechanical art to something like perfection, has nevertheless been abandoned

as a special branch altogether foreign to astronomy. This room in the Observatory serves now-a-days chiefly as a depôt for all the chronometers belonging to the royal navy which are not for a time in use in the various vessels. It is also true, on the other hand, that many of the English instrument makers send their chronometers to Greenwich to be tested; these instruments then are candidates, and if they firmly stand their ground during the severe scrutiny they are made to undergo, they subsequently have the honour of being purchased by the Admiralty.

Every day two assistants preside at this series of trials. To have to compare with one another more than a hundred watches, so as to learn the merits and defects of each, and to find out their slightest errors, seems at first sight an enormous task—one which would absorb a man's whole life. Well, this is not the case, for these trials of accuracy are accomplished every morning with a marvellous rapidity. In the first place, one of the assistants winds up all the chronometers in succession; this being finished, he sits down at a table and enters in a book the figures which are announced in a loud voice by the second assistant, who compares all the watches one after another with a clock placed between the two windows. This is one of the sympathetic sisters of the motor-clock, and is, in consequence, one of the absolute standards of the division of time. Each watch having been, thus, as

it were, brought to confession, it is easy to see the nature of its sins; and this scrutiny lasts for months. When I visited this department of the Observatory, noticing one of the chronometers which varied ten minutes from the *mother-clock*, I made a remark about it to Mr. Creswick, one of the assistants. "Here is one," said I, "which is going badly." In reply, he brought under my notice that this chronometer had been in the establishment since January, 1866, and it was then August. I was obliged to confess that I should be ready to bless my watch if it gained or lost only ten minutes in eight months. Another chronometer, on the other hand, marked exact time. "At any rate," said I, "this is an excellent one." The answer made me was, that at present very little could be known about it, "on account *of its not having yet crossed the line.*" These chronometers being destined to traverse every sea, and to visit all the different climates of our globe, it is considered necessary to submit them in succession to various artificial temperatures. To experience a cold temperature, they are placed in the shade in the corner of a window facing the north; but it is heat, much more than cold, which is dreaded for the chronometers. I was soon shown about forty of them who were travelling, as it were, under the *equator*. What other name can be given to a species of oven heated by the flame of gas up to the temperature of eighty degrees, in which these neophytes have

to undergo the ordeal of fire? When these chronometers have thus, without flinching, passed through all the extremes of climate to which other time-pieces show themselves so very sensible, they certainly have a good right to a recompense. In conclusion, the Astronomer Royal finally decides on their value, and on his personal responsibility recommends them to Government for the use of the fleet.*

The science of the measurement of time is one of the pursuits most practised at Greenwich Observatory, and it certainly has its grandeur as well as its utility. The heavens, however, are not the only subject of study which is pursued in the establishment. The standards of weights and measures having been burnt in 1834, at the conflagration at the Houses of Parliament, the Astronomer Royal was nominated president of a commission deputed to reconstruct them according to certain mathematical principles. There are, in fact, to be seen on the outer wall of the Observatory the types, in bronze, of the national measures—such as the foot, yard, and inch. Few persons are ignorant that the English have not yet adopted our decimal system, which they accuse of certain inaccuracies. The *savants* at Greenwich are, besides, occupied in the considera-

* Owing to the great experience of the astronomers at Greenwich, the nautical telescopes and glasses are also occasionally submitted to their scrutiny. A control of this sort cannot fail to much improve the construction of these instruments.

tion of a whole series of obscure phenomena more particularly appertaining to our terrestrial globe, but which, nevertheless, form a portion of the general study of the cosmical system. Another Observatory, for magnetic and meteorological objects, has been subsequently added to the Observatory more especially devoted to the survey of the heavenly bodies.

This fresh Observatory was established about 1837. In the first place it was necessary to find the ground for it, for the kind of isthmus in the midst of an ocean of verdure on which the old Observatory stands was already completely occupied with buildings. Taking away a portion of a royal park is, with our neighbours, no trifling matter; the consent of the Commissioners of Woods and Forests was, however, obtained, as well as that of the Ranger of the Park. In 1838, a wooden building had been erected in the enclosure which had just been cut off from the public promenade. The new Observatory was instituted, and still continues, as a dependent of the old one, but was placed under the superintendence of Mr. Glaisher, a *savant* of great energy, well known, especially of late, to the English public by his famous aeronautic ascents.

This department is entered through the wing of the building in which the *great equatorial* stands, and by following a narrow path which skirts the private garden of the Astronomer Royal, we reach a piece of ground enclosed with black planks, instead of a wall.

Just at the entry stands a lofty mast eighty feet high, to the summit of which is fastened an iron wire, intended to gather the electricity of the atmosphere, and to conduct it to the interior of the buildings, where it is subsequently analysed by divers appliances. These buildings are constructed according to a peculiar system, and even at first sight present several curious features. Not only are they built entirely of wood, but even cane pegs are made use of, instead of ordinary nails, to fasten the different parts together: iron and electricity are two friends, whose meeting it is important to prevent in such a locality. The windows, with large panes of yellow glass, show, on the other hand, that the colour of the light is by no means an unnecessary ingredient in the success of the delicate experiments which are practised here. It was even deemed necessary to construct, in 1864, with bricks expressly selected, a subterranean chamber, in order to guard the large magnetometers against every variation of the temperature. These instruments are covered with a casing of plank, and are hidden up as mysteriously as the occult forces of nature which they silently examine; they are all of the sort which are called by the English *self-registering* instruments; that is, they record for themselves the results obtained. Our present century has witnessed the origin of two discoveries most valuable to science—electric telegraphy and photography. We are already aware of the

benefit which Greenwich Observatory has derived from the former; the second is of but little less service to it.

The slightest variations of the magnetic needle, the degrees of temperature at every hour in the day, the winds and their direction, the quantity of rain falling on each day, the amount of electricity with which the clouds are charged, the differences in the atmosphere—all these phenomena awaken the sensibility of certain instruments which it would be necessary to consult at almost every instant in the day—at least every five minutes. Since about 1844 all these instruments have been *taught to write.* Provide them with a sheet of photographic paper, and in a given time they will cover it with the results of their own special observations. They work all the week, and, as if to relieve the consciences of the English, even on Sundays. On the latter day the negative proofs are taken away from under the cylinders and placed in a dark cupboard, where they await the ordinary process for bringing out the impression. Fresh sheets of paper are then substituted, and the instruments are left to do the rest of the work. The photographic proofs are afterwards collected and multiplied by means of a process invented by Mr. Glaisher, and subsequently bound in volumes. I have myself inspected the lines thus traced on paper, and they are really of admirable distinctness, and by their zigzags sufficiently indicate the slightest deviations of terrestrial magnetism, and

of the various atmospheric agents. We have thus before our eyes a history of the elements recorded by themselves.

At the time when I visited the magnetic and meteorological observatory at Greenwich the cholera had just broke out in London, and I was naturally curious to know if any traces of alteration in the air had been discovered. The Astronomer Royal brought to my notice, between the trees in the park, a rather dense blue mist, which seemed to creep out of the ground and make its way up among the foliage, where it by degrees melted away. This singular fact, to which Mr. Glaisher had some days before drawn the attention of the learned world, coincided with an exactly similar phenomenon which he had remarked in 1854, at the time of another invasion of the epidemic. The most singular thing about it is, that whilst ordinary fogs disperse under a certain pressure of wind, in the present case, although the wind had blown with more than sufficient force for about a week, this obstinate mist still remained colouring the park walls with its blue shade. Mr. Glaisher informed me also that the instrument intended to collect the electricity of the air afforded but very little since the appearance of the plague. With the exception of these meagre indications, which, nevertheless, give some ground for reflection, there was nothing noticed which announced any change in the general state of the atmosphere.

The formation of storms is another subject of investigation to which the attention of the *savants* at Greenwich has been for some years directed. From 1841 to 1857 one hundred and seventy electric storms have been analysed, and an instrument is employed to ascertain the spontaneous currents of electricity which traverse the interior surface of our planet. Two wires, one coming from Croydon and one from Dartford, are conducted to the inside of the Observatory, being in connection with the ground at the two extremities only, and perfectly isolated along their whole length. The light of a lamp falls upon each apparatus, both being enclosed in a case; it first strikes a cylindrical lens on a vertical axis, and, by means of an ebony roller covered with photographic paper, making a complete revolution every twenty-four hours, it traces out, as if under the dictation of the two wires, the account of these mysterious terrestrial agents, to the instrumentality of which we have reason to attribute no small importance. Everything, in fact, leads us to believe that they play a considerable part in the various perturbations of the elements. On the 2nd of August, 1865, the Astronomer Royal, on examining the photographic proofs, was struck by the violence of the electric currents indicated on the paper by the abrupt variations in the lines. One might have compared them to the scrawl convulsively traced by the hand of an epileptic. It was soon known at the

Observatory that this very day the signals of the Atlantic Telegraph had ceased to be intelligible. As this cable has been since taken up again, and will soon work more beautifully than ever, it would be easy to ascertain if certain spontaneous magnetic currents have the influence on the abysses of the ocean which Mr. Airy was inclined to attribute to them.

Among all the instruments which *speak and write*, one of the most curious is certainly the *anemometer*, by Osler, a mechanician at Birmingham, who has found out a way for attaching a pencil to the wings of the wind. The plan is something as follows:—The wind gives motion to a vane, and, by means of a toothed wheel connected with this, and with a small table in the western tower, this motion is transmitted to a pencil which works backwards and forwards according to the changes in the vane, and thus marks on the paper the directions of the gusts of wind. Thermometers are incessantly interrogating the temperature—in the shade, in the sun, in the water, under the earth at depths varying from one to twenty-four feet. In the last case the order of the seasons is found to be inverted, for the greatest heat is found in December. On the Thames, nearly in front of the Observatory, there lies a vessel called the *Dreadnought*, which serves as a hospital for sailors. To the black sides of this ship are suspended barometers belonging to the Observatory, which indicate the state of the atmosphere on the river

at every moment of the day. The information collected in this way is all the more curious, as the Astronomer Royal considers the Thames as a great artery exercising very considerable influence over the climate of London and its environs. A large number of barometers are thus at work both day and night. The greater part of them perform a double duty; they have both to mark the variations in the column of air, and to note them down by photography. The form of the instrument itself assists in this mode of writing; we may, in fact, easily understand that a ray of light would act differently on the portion of the tube filled with mercury and on the empty part. Thus the least movements either of the liquid rising or falling could not escape the well-known process which equally serves to reproduce the features both of men and things.

It would be useless to enumerate the various other self-registering instruments; suffice it to say that there is not one of the secret agents of nature, either good or bad, which does not itself in like manner record its services or bear witness of its misdeeds. The results of these indications are sent every day to the Observatory at Paris in the form of a bulletin. But still, in spite of the multitude of facts collected with so much care, meteorology is, as a science, in a rudimentary state. We know exactly the different degrees of atmospheric pressure, of humidity, of temperature, and of the force of the wind; some even of the effects of

electricity have been obtained; but who is it that can lift the veil which conceals the laws of these phenomena? Until the causes become known, little else can be done but to collect materials for a cosmical system. In the present state of things, even observers themselves agree that meteorology is a chaos, the elements of which are awaiting the *fiat lux* of an idea to enable them to take some consistent form.

There are certainly but few establishments in the world which are more useful than that at Greenwich, and yet it is surrounded with enemies. Whilst it was watching the celestial movements or investigating the hidden agencies of nature, the iron serpents with which the surface of Kent is everywhere intertwined have been seeking to invade its territories. The war between the Observatory and the railways is not of very recent origin, and dates back as far as 1835. Since then various projects have been rejected by the Houses of Parliament; but the companies constantly return to the charge. The effect most dreaded by the Astronomer Royal from the proximity of railways is the shaking of the ground, which might possibly disturb certain delicate experiments. In 1846, however, he gave his consent that the line of the South Eastern Railway Company should cross Greenwich Park through a tunnel at a distance of 1,800 or 1,900 feet from the rooms of the Observatory. The weight as well as the speed of the trains was to be fixed by strict enactments,

and under these conditions it was thought that the injury done to science could not be very great. The observatory at Edinburgh is built on the Calton Hill, which is intersected by the North British Railway; the soil is a hard rock, and consequently of a nature which would very easily transmit any vibration. Nevertheless, the instruments have not hitherto suffered from the passings to and fro of their noisy neighbour. The project named above was, however, abandoned, but only to make room ere long for another scheme still more dangerous in every point affecting the interests of astronomy. The plan now was to bring through London to the various parts of Kent the whole goods traffic from the north of England, and all this was to be carried through Greenwich Park. Such an idea, if carried out, would be the ruin of the Observatory.

In fact, so great is the sensibility of some of the astronomical instruments, that in October, 1863, the altazimuth, although firmly fixed on its column, was shaken by a very slight earthquake. What, then, could be expected from the heavy concussions communicated by the motion of the goods trains? At Watford, in Hertfordshire, a railway passes through a tunnel some distance from the observatory there, and the tremor which affects the ground is quite strong enough to disturb the labours of Sir James South, the astronomer. The Board of Visitors, therefore, can hardly be in the wrong, if, fully aware of the facts,

they have requested the Government to for ever exclude the iron-bound roads from the park at Greenwich. Manufactures and Trade, as the daughters of Science, ought at least to respect their mother.

There are two kinds of astronomy—one isolated in all the sublimities of mysticism; the other, of a more practical nature, whilst surveying the heavens, by no means loses sight of earthly interests. Greenwich Observatory has devoted itself to the latter branch, wisely relinquishing the vain pretension of endeavouring to excel in every phase of the science. Its own traditions and the point of national honour have thus willed it. Its origin having been simultaneous with the development of the art of navigation, of which it now guides the progress and rules the destinies, this establishment has exercised a happy influence over the maritime education of the country. The day when the Anglo-Saxon race first discovered the benefits they might derive from navigation and commerce, they then happily fixed the star of their destiny; but nothing great can be achieved without the concurrence of science. When an enemy like the sea has to be dealt with, personal courage is by no means equal to the practical questions of shortening distances and diminishing obstacles. Let poets, if they will, embellish the facts in their songs: as they would have it, England's

> "march is o'er the mountain waves,
> Her home is on the deep."

Tempests are to be her ramparts, and the extent of ocean is to be but the highway for her conquests. All this may be very true, but still it needed the eye of the astronomer to survey the heavens, and his finger to point out to the mariner those luminaries of night which are selected to guide his course through the dangers of the deep. The information sent out from Greenwich does not belong to England only; it is the property of the whole world. It is a peculiarity of the perceptions of science that they never can be hidden under the bushel of national selfishness. Are not the material interests of all modern nations more than ever blended on the surface of that mighty ocean which draws closer together races and their commerce? The sea, which is the connecting link of climates, is also the bond of human brotherhood.

CHAPTER IV.

THE ADMIRALTY—THE DUKES OF BUCKINGHAM—ASPECT OF THE EDIFICE —THE OFFICES AND THE BOARD-ROOM—HOW THE MARITIME POWER OF ENGLAND WAS FIRST CONSTITUTED—THE ELECTRIC TELEGRAPH AND THE ADMINISTRATION—TO WHOM DOES THE FLEET OF THE COUNTRY BELONG?—THE FORMER LORD HIGH ADMIRAL—HOW AND WHY HIS DUTIES WERE INTRUSTED TO A BOARD OF COMMISSIONERS —ORGANISATION OF THE BOARD OF ADMIRALTY—DISTRIBUTION OF BUSINESS—PREDOMINANCE OF THE FIRST LORD OVER THE OTHER MEMBERS OF THE BOARD—OBJECTIONS WHICH MAY BE MADE TO THIS FORM OF ADMINISTRATION—CAUSES OF THE CRISIS WHICH IS NOW INFLUENCING THE BRITISH FLEET—IRON WALLS SUBSTITUTED FOR "WOODEN WALLS"—THE WEAKNESS OF NEIGHBOURING NATIONS SHOULD BE NO DESIDERATUM BY TRUE PATRIOTISM—WANT OF CENTRALISATION NO BAR TO NAVAL SUCCESS.

CONTINENTAL politicians have expressed surprise at the calm and almost careless attitude assumed by Great Britain throughout all the momentous events which have lately remodelled the map of Europe. But it would not perhaps be difficult to arrive at some of the causes which have led to this spirit of non-intervention. England looks upon herself as pre-eminently a *maritime* nation. Her empire is not on the land—she "rules the waves;" at least it is by means of the ocean that she maintains her rank in the world, and continues to keep in hand her vast colonial possessions. Do not interfere

with the sea! This is certainly the warning motto of her policy. What does it matter to her if this or that continental state acquires an aggrandisement of territory? But the idea that Prussia should be able at any given time to create a fleet—this is, indeed, a very different and a very real source of uneasiness. With what a jealous eye does she also scan the incredible progress made on the other side of the Atlantic by the United States navy! This democracy of the New World, which contends with her for the supremacy in her own special field of naval warfare, absorbs a larger portion of the attention of British statesmen than a series of victories on land, destined perhaps to unsettle the boundaries of empires.

The conclusion I wish to draw from these facts is the importance which the English attach to their fleet. On their ships they depend, in great measure, for influencing the fate of their armies, and insuring the ascendency of their commerce. In order to understand the organisation of the royal navy, we must first devote some study to the power which directs it. The Admiralty, although it has nothing to do with the management of the mercantile marine, may be looked upon, in a manner, as the Palladium of a nation of navigators.

In Parliament Street, in London, stands an edifice of dark brick, the main building of which shrinks back at the end of a damp and gloomy-looking court. To bring it in a line with the frontage of the street, it was

necessary to add two wings, which do nothing to improve the naked monotony of the architecture. This is, nevertheless, the spot where the Admiralty hold their councils. The English have long back affected a contempt for the representative forms of architectural grandeur; one might even venture to say that they made it a point of honour to conduct the business of the State in edifices of a mean and simple character. But the striking contrast between the dignity of a great maritime power and the shabby poverty of an official residence like this seems to have struck our neighbours themselves about the middle of the last century. In 1776, two architects, brothers named Adam, were intrusted with the task of masking, by a stone-work screen, the irremediable ugliness of the main building. Have they succeeded in their aim? I, for one, very much doubt it; certain emblems, such as winged sea-horses, the prow of a Roman galley contrasted with the bows of an English man-of-war, all carved with a skilful yet somewhat timid hand, serve at least to show clearly enough the character and intention of this public building. Devoid, as it is, both of elegance and beauty, it nevertheless wins approval by the memory of ancient reminiscences, which is always a claim to favour among a people so enamoured of their national history

The building now known as the Admiralty was in bygone days called Wallingford House, thus named,

says Pennant, the celebrated English chronicler, because this house had been the residence of the Knollys family, the Lords Wallingford. Oliver Cromwell held some of his councils here, and here too was born the famous George Villiers, Duke of Buckingham, who became in 1666 a member of the administration so well known as the *Cabal*. The Restoration had reinstated him in the possession of a revenue of £20,000, which he wasted in every kind of extravagance. Son of the Duke of Buckingham who was the favourite of Charles I., and was assassinated during his reign, the second George Villiers was in turns alchemist, painter, poet, musician, statesman, a wit without judgment, and a debauchee turning night into day; ambitious and extreme in everything he did, he surpassed even the court of Charles II. in his eccentricities and vices. Dryden has handed down to us a portrait of him, traced with a master's hand, and painted in dark colours, although he has done no more than expose the absurdities and follies of this singular character, designedly leaving in the background more than one tragic episode.* The Duke of Buckingham, having run through a princely fortune, died, according to Pope, "in the worst inn's worst room," and, as others say, at the house of one of

* George Villiers was the lover of the Countess of Shrewsbury, whose husband he killed in a duel. The spot is still pointed out in the Duchess of Sutherland's park at Cliefden, where the Countess, disguised as a page, held her lover's horse while the duel was being fought.

his tenantry at Kirby Mallory. It was not until the reign of William III. that the Admiralty located its offices in the former residence of this veteran prodigal son.

I visited with much interest this central point of England's maritime power. The manners and behaviour of the public functionaries in Great Britain have but little of that official stiffness which distinguishes them in other countries. The greatest courtesy was shown in conducting me through the offices, and pointing out to me all the objects of interest: the former bowling-green of the Dukes of Buckingham, now turned into a garden, the room in which Nelson was laid in state after his death, whence he was carried in great pomp to St. Paul's Cathedral, the original model of the statue which now figures in Trafalgar Square, the library, the ante-chamber of the First Lord of the Admiralty, the walls of which are ornamented with a trophy of arms, and the council-chamber. Historical reminiscences, and the association of ideas, give a life to the interior of this building which would otherwise be dull enough.

How many men, celebrated in the naval annals of the country, have gone up this stone staircase! In this old leather-covered chair Captain Cook may have sat down. I was shown the roll in which the Admirals of Great Britain used in former days to register their oath of allegiance to the State by affixing their signatures to a profession of faith. They pledged themselves

on their honour to exclude with all their power the doctrine which sanctions the authority of the Pope in religious matters, the belief in the real presence, and other articles of the Roman Catholic creed. What, it may be asked, have these dogmas to do with the direction of a fleet? It must not, however, be forgotten that if, since the sixteenth century, England has several times resisted almost alone a continent in arms, she has done it by opposing against them two ramparts —Protestantism and the sea. How many great names figure in this list of brave men, a few of whom have borne witness with their blood to the sincerity of their devotion to this double oath—the love of their country and the liberty of thought!

The board-room, in which the Lords of the Admiralty meet, has but little to mark it except the walls, lined with ancient wainscoting curiously carved and cut out with the chisel. Here, too, we again meet with Nelson, but this time only in painting; this portrait of him, which is, however, wanting in relief and expression, was taken at Palermo, in 1799, by Leonardo Guzzardi. At the head of a table covered with green cloth stands the chair of the president, or First Lord of the Admiralty, the places of the other members of the board being marked by arm-chairs seated with red leather. In a word, this room is both old and gloomy, ill-lighted, and quite without ornament; it is, nevertheless, here that all the most important questions are

decided which concern the interests of the royal navy.

The Admiralty certainly represents the head of the naval administration, but it is connected with a body the members of which are dispersed over the whole of Great Britain. To take London only into consideration, we find naval business distributed between various sub-offices, one of which is situated in Spring Gardens, and another at Somerset House. One simple fact will easily explain this administrative dispersion, which is, nevertheless, at first sight, surprising to foreigners. Like almost all the other branches of the English Government, its maritime power is constituted by means of distinct elements which have been of necessity compelled to extend and associate themselves just as the material prosperity of the country increased, but still have never been allowed to be completely absorbed by one great centre. The naval system of Britain has grown with the nation, and if I may use the expression, it has not been *made*, but has developed itself. It will not do, therefore, to expect that system of artificial order which springs from the will of one man; but it does possess that natural order which follows the laws of free development. This is the reason why it can easily assume the almost spontaneous form impressed upon it in recurring ages by the temperament of the Anglo-Saxon genius.

This state of things of course brings with it some in-

convenience, and they have been compelled to resort to means for mutually uniting these divided portions of the system. One of the offices is devoted to the transmission of the orders proceeding from the Admiralty; and, thanks to the electric telegraph, they soon radiate to every point of the kingdom. By the intervention of these constantly vibrating wires, acting for the centre of administration just as the nervous system does for the brain, the board is enabled to telegraph their communications to the various sub-offices in London, to direct the labours in the Government dockyards at Portsmouth, Sheerness, or elsewhere, and even to launch a frigate into the deep. These galvanic appliances differ but little either in construction or action from those employed elsewhere; but there is something imposing in the silence of a room, the air of which is, as it were, full of important information and secret messages of State. The orders that they were transmitting just when I visited the office were doubtless of no very great importance; but the action of the passionless mechanism would have been the same, had it been commissioned to organise a great naval engagement. The lightning-flash of the command destined to awake the voices of the cannon leaves and travels equally without sound.

The defensive forces of England consist of a fleet and an army; but a characteristic feature entirely separates their respective administrations. The army is reputed

to belong to the Queen, who is represented by a Commander-in-Chief—at present the Duke of Cambridge; but it is quite different with the fleet. Whether it be that the Crown has yielded up its rights over the navy, or whether these rights never existed—opinions differ on this point—the fact still remains the same, that the direction of the fleets is placed in the hands of the Lords of the Admiralty. Whence is this power derived, and how was it first constituted? This must be briefly explained.

A High Admiral existed in England even before the State possessed any fleet. If the sovereign wished to undertake some naval expedition, he exercised the power he possessed of *pressing* into his service the merchant ships which were lying at the time in the various seaports of the kingdom, and without any scruple compelled their assistance, by force if necessary.* With regard to the officer commissioned to superintend all these warlike preparations, as well as the general interests of the fleet, he bore at successive periods various titles pretty well showing the nature of his duties. He was at first the *Custos Maris;* then, as the maritime lieutenant of the Crown, he was called the *Locum tenens super Mare;* and, in 1297, the King of England's Admiral of the Sea. He was sometimes

* Recent studies have proved that certain royal ships served doubtless as a nucleus to these improvised squadrons; but the system of a permanent fleet was not introduced into Great Britain until the reign of Henry VIII.

entirely unacquainted with naval battles and the manœuvres which they required, very often being a son of the king or some member of his family. Nothing compelled him to command the fleet in person, and it was considered sufficient if he organised and directed the naval forces from a distance. He had not even, like Louis XIV., to curse "the greatness which chained him down to the sea-coast." This office continued to exist, and was transmitted from one to the other, until September 20th, 1628, the epoch when, for the first time, it was intrusted to a board, and no longer to one individual only. This took place a short time after the first George Villiers, Duke of Buckingham, then Lord High-Admiral of England, had been assassinated by Felton. Weston, the Lord Treasurer, Earl Lindsey, and some other eminent men, were called on to fulfil in common the duties of the office left vacant by the death of the duke, who must not be confounded with his son, the lover of the Countess of Shrewsbury.

Since then, the two systems have, in a manner, disputed for the field of action, and, from time to time, the attributes of the Lord High-Admiral have been seen to reappear, personified in one of the chief officers of State. Thus it was that Cromwell grasped with his encroaching hand the rule of maritime matters, which had for several years been carried on by a parliamentary committee. After him, the Duke of York (brother of Charles II.), Charles II. himself, Prince George of Den-

mark, and the Earl of Pembroke, revived at intervals the dignities of an office which always tended towards the vanishing point. In fact, for more than a century and a half, with one single exception—that of the Duke of Clarence (afterwards William IV.), who was Lord High-Admiral of England from 1827 to 1828—the affairs of the navy of the State have been always administered by a council or board. The functions of the former Lords High-Admiral consisted, on the one hand, in maintaining and superintending the naval forces of the kingdom, and, on the other, in administering justice in all the suits which could be caused by disputes arising on the seas. The first of these duties is at the present day carried on by the Board of Admiralty itself; the second is delegated to a tribunal bearing the name of the High Court of Admiralty, a court exercising jurisdiction in all maritime matters, whether civil or criminal.

The board, which in England governs the royal navy, consists of six members and two secretaries. The First Lord is generally some statesman, often quite unacquainted with nautical matters; he is a member of the Cabinet, and pretty nearly represents what we call in France *le Ministre de la Marine.* The second, designated by the title of Senior Sea-Lord, is, on the other hand, considered naturally as the adviser of his chief in all matters of business calling for technical knowledge, and touching closely the nautical profession.

Very often he is the only one of the board who really has, as is said, tasted salt water and snuffed up the smell of the tar. The sixth member of the board, or Junior Lord, is generally some young man of high birth who is anxious to try his hand in political life, whom his friends wish to push forward in the official world by first giving him some practice in dealing with the maritime affairs of the kingdom. All these commissioners are nominated by the Queen, and come into and retire from office with the ministry whose political fortunes they share.

On entering upon their duties, the Lords of the Admiralty begin by partitioning out among themselves their field of labour. A printed list, bearing the title, "Distribution of Business," sufficiently defines the description of business which custom has assigned to each of the Lords according to his rank at the board. This arrangement, by virtue of which the council delegates to its several members a portion of its collective rights and duties, does not, however, obtain any character of publicity. It is entirely a private agreement, and the Board of Admiralty does not any the less remain a kind of council of six, indistinguishable and veiled to the country at large. The far-extended sphere of its powers embraces the administration of the fleet, both at home and abroad, the handling of the naval forces, the control of the dockyards, and the other Government establishments more or less connected with the sea-service.

Its prerogatives allow it to nominate officers to the different ranks in the military or civil departments of the royal navy, to authorise and pay the expenses, to have ships either built or repaired, and to have a voice in the regulation of the various schools of navigation which belong to the State. All these matters of business are generally settled in council. These meetings are regularly convened, but the decisions arrived at are not submitted to the test of a ballot. The members of the board never vote, and content themselves with merely expressing their opinions. According to a custom consecrated by time, the First Lord enjoys a kind of supreme authority. It may happen, for instance, that in his capacity as member of the Cabinet, and as thus being in possession of the secrets of Government, he might require the preparation of certain armaments, or a fresh distribution of the naval forces, without wishing to communicate his reasons to the board. The other Lords have, in this case, the choice between two alternatives: to agree or resign, and it is but seldom that they adopt the latter course.

The minister has, of course, more than one grave motive which enables him to justify his silence. Would it be proper for him to noise abroad the intentions of Government by confiding them to men, honourable, no doubt, who, however, through absence of mind or carelessness, might inadvertently let drop a hint of them at their clubs? There is, nevertheless, an obvious anomaly in this course of procedure. It is a council covering

with its collective responsibility acts which it has not the power to thoroughly examine into. The assent of the commissioners becomes, in a case like this, a mere mask for the will of the minister. Nevertheless, in general the First Lord pays a certain deference to the expressed opinions of the other commissioners of the Admiralty in anything that concerns those details of the administration with which they are personally charged. He does not, however, preside at all the decisions; two commissioners and a secretary are sufficient to constitute a board. The first secretary is usually a member of Parliament, and when the minister sits in the House of Peers he is very often the only organ which the Admiralty possesses in the House of Commons.

The *régime* of boards has now been for some time the object of tolerably sharp criticism in England. The fault found (and justly so) is, that it weakens, by dividing the responsibility of, certain powers. Who can be either praised or blamed among a group of individuals shrouded from our gaze in the midst of an artificial co-responsibility, who also follow one another in office without leaving any distinct trace of their passage? In a country in which public opinion rules, this public opinion demands some tangible flesh-and-blood functionaries to deal with, and not mere shadows, which, like the divinities of Homer, disappear into a cloud the moment they are touched with the point of the spear of

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criticism. But has the Admiralty, more than any other public board, found any special favour when attacked by a free press? Certainly not; indignation rose high among our neighbours when Sir John Pakington, then First Lord of the Admiralty, lately declared in Parliament that he had in reserve scarcely any ships which were immediately ready for launching. The country bitterly called to mind the seventy millions of pounds sterling which had been expended during the last seven years with a view of increasing the national fleets; and cries of alarm went up from all parts of Great Britain.

There is, doubtless, some exaggeration in many of the comments to which this ministerial declaration gave rise, and I should really pity the foreigner who believed, word for word, all that our neighbours tell him when they are discontented with public matters. Englishmen, in everything relating to the interests of their country, very much resemble some husbands who constantly find fault with everything at home, but will by no means allow any one else to say a word against their housekeeping. It always seems to be the case that the existing state of naval affairs in no way corresponds either with the expectations conceived about them or with the pecuniary sacrifices which, during the last few years, have been so lavishly made. Each fresh minister coming into office uses pretty nearly the same language as Sir John Pakington. Can this be intended merely to cast a reproach on the preceding

administration? I do not think so. Everything, on the contrary, seems to point out that it is a chronic complaint from which the British navy is suffering. Beyond any faults which may be laid to the constitution of the Board of Admiralty, there are various causes which sufficiently explain that the naval service is going through a crisis of transition and uncertainty.

An attentive observer could hardly have passed unnoticed the questions considered some years back during the ministry of Lord Palmerston. It will be recollected that the English Government for the first time proposed to construct great defensive works on the sea-coast, and obtained from Parliament large sums of money in order to put its plans in execution. Fortifications!—and why? Englishmen in the last century disdained the idea of fortifying their coasts, and threw down their defiance to the whole world even to reach them. "The sea," said they, "is our battle-field, and since Admiral Ruyter, who can boast that he has forced the mouth of the Thames under an enemy's flag?" I am not in any way called upon to judge as to the expediency of the vast works which England every year is finishing, or still progressing with, at the cost of enormous pecuniary sacrifices; all I see in it is an avowal of uneasiness. The construction of stone bastions and redoubts is a fact which loudly enough proclaims that our neighbours now no longer altogether trust to the infallibility of their former "wooden

walls." What can have had sufficient power to shake this long-dated confidence in the protection of the sea? Whence arises the cause for Great Britain having thus seen a large portion of her power melt away—for this fact cannot be lost sight of?

The material conditions of a man-of-war fleet have been entirely changed during the course of the last few years. In the old time England reckoned chiefly on the courage and experience of her sailors for maintaining her ascendency over the empire of the seas. Born on the coasts of a narrow island,* they were like Tritons, and in their earliest days became habituated to both elements, their infant glances being often directed to the sea first. The powers of steam applied to the use of vast line-of-battle ships, and quite recently to iron-clad frigates, have singularly curtailed the part which personal qualities can henceforth play in naval matters. A war of machinery has in great part taken the place of a personal contest between man and man. Although the intelligence and courage of the combatants must always surely be the animating spirit of these new marine monsters, it is certain that individual power will almost entirely disappear behind these iron masses carrying their thunders in their impenetrable sides. It can, therefore, be no cause for astonishment that these recent inventions have for

* It is calculated that no part of England is more than eighty or ninety miles from the salt water.

the moment disconcerted the old maritime genius of England, accustomed as she is to a long series of successes gained by quite different means.

Whether this new field of contest with other nations be advantageous or not, it was doubtless necessary to accept it. England, from her insular position, her past history, the extent of her commercial relations, and of her colonial possessions, can only exist on the condition of being a maritime power of the very first class. She has therefore entered, though with some tardiness and a certain visible repugnance, on the path of mechanical improvements as applied to ships-of-war. The English, being the nation of machinery, could, if they chose to exert themselves, soon regain their superiority in a field so adapted to their energies; but time seems necessary to make them recognise this fact. The iron-clad Leviathans—the *Warrior*, the *Minotaur*, the *Northumberland*, and several others—gradually made their appearance from the royal dockyards. But various obstacles stood in the way of the rapid development of the new system. It is not want of money to which I allude, for, in spite of the immense expenditure involved, the country had made up its mind beforehand to submit to any sacrifice to protect its position on the seas, now for the first time menaced. Since the "wooden walls" have had their day, England now looks to her walls of iron for means for regrasping her supremacy.

The cause which has delayed the movement of reconstruction in the English fleet is the same cause which has somewhat paralysed the ardour of statesmen everywhere. Discoveries and inventions in our time follow one another with such rapidity, that, in the midst of all these *dissolving views* of device, the mind floats in uncertainty from one plan to another. What scheme is to be chosen? Where are we to stop? The chimerical projects of yesterday become, one after another, the realities of the present, and the vain lumber of to-morrow. How can it be right to hazard the fortunes of the country on this or that system of armament, when it will be perhaps necessary, at the end of a few months, to begin the same expenses over again on a system considered still more efficacious? To speak of ships only, there is now a continuous rivalry between the cannon-ball and the armour; and we find that the strength of the iron casing has every day to be redoubled, penetrated as it is time after time by the force of the projectiles. The thing sought after is the ideal of a ship-of-war both incombustible and invulnerable; but at the very moment when it is thought this aim is attained, this imagined standard of perfection vanishes away in the smoke of the experiments. Every one must easily perceive that a state of things like this must have often embarrassed the Lords of the Admiralty. Certainly the force of one strong will might have triumphed over these obstacles; but

how can such an inflexibility of resolution be expected from a body of men unacquainted for the most part with naval matters, and from a council the responsibility of which is constantly cancelled by the will of the minister? If the day should ever come when the English nation should feel called upon to bring the Admiralty to account, whom would they accuse, the former or the present Lords? A veil, impenetrable to the public, is spread equally over the actions of both bodies.

The scourge of public boards in England is the system of routine. In all these councils it is the same class of the community which, under different political colours, administers, from generation to generation, the departments of Government. In a time of peace the nation lets things go quietly on, well aware that, at any critical moment, it can lay a heavy hand on the helm of State. Let a war arise, and public opinion, awakening with a start, will call, in an imperious tone, for measures and reforms suited to the exigency of the circumstances. This is just what happened in 1854, when the campaign in the Crimea warned our allies as to the requirements of the English army. Will the fleet be in the same case? Will it need a war with America to rouse up the administrative *inertia* of Great Britain? God forbid that it should be so! The selfishness of barbarous ages, discarded by degrees from our social intercourse, has, as a last resort, taken refuge in the mutual relations of states, and here, in

its last sanctuary, it still with difficulty keeps its place face to face with the progress of civilisation. What a narrow-minded patriotism do those show who would rejoice at their neighbour's declension in maritime power! Every nation in the world has an interest in other nations being also strong, were it only to diminish the chances of war by curbing the mad temptations of ambition.

One thing is, however, certain—England is as yet very far from having arrived at that point at which her carelessness and her weakness can afford any encouragement to the naval enterprise of a rival. The resources of the country are perhaps more considerable than ever, and her sailors have by no means degenerated. This may be easily perceived in the adventurous spirit and courage which constantly distinguish the mercantile marine of the United Kingdom. What, then, has been the *desideratum* in these recent times? A man with full power, seriously responsible for what he does. And yet, let me not be misunderstood. No change is called for in the groundwork of the maritime system as it has been laid down in England by the efforts of the whole country and the autonomy of the naval authorities. The English are no organisers, and they have but little reason to regret the defect, for it is owing to the want of this faculty that the various services in the State have been enabled to preserve their free action. The British navy is

under a sort of self-government, in which the parties interested always find means in one way or another to make their voices heard in its councils. But who would dare to maintain that this *régime* has at all impaired the glory of the national flag? Englishmen —*we* know it only too well—had no need for that centralisation so much boasted of in France in order to win the victory at Trafalgar. The demand that might rightly be made on the other side of the Channel is for some system which would both secure the spontaneous co-operation of the numerous elements composing the naval forces of the State, and at the same time more distinctly point out the men who are placed at the head of their administration.

It would be needless to dwell upon the various branches of the public service which are associated in the offices at the Admiralty. One of the most interesting is beyond doubt the province of hydrography. From this department proceed those admirable charts, well known all over Europe, on which we find indicated, with the most minute fidelity, the smallest sand-banks formed from time to time along the coasts of England, and all the other perfidious dangers of the deep, even to the exact shape of the most distant isles or promontories. The Coast-Guard Office is another branch of the naval administration which is in correspondence with the Admiralty, and is situated in Spring Gardens, not far off.

CHAPTER V.

CAUSES WHICH ORIGINATED THE COAST-GUARD SERVICE—LEGENDS OF BYGONE SMUGGLERS—WHAT HAS MOST CONTRIBUTED TO PUT AN END TO CONTRABAND TRADE—CONDITIONS FOR ADMISSION INTO THE COAST-GUARD—THEIR UNIFORM—GOOD-CONDUCT STRIPES—ACCIDENTS TO WHICH THEY ARE EXPOSED—LIFE-BOAT SERVICE—THE FOUR PEVENSEY COAST-GUARDSMEN—SAILORS' COTTAGES AND HOMES—THEIR WIVES—THE COAST-GUARD STATION AND WATCH-TOWER—A SMUGGLER HEROINE—VESSELS AND BOATS OF THE COAST-GUARD—DEVOTION OF THESE MEN, AND THE RECOMPENSE THEY RECEIVE FOR THEIR SERVICES—THEIR RETIREMENT AND OLD AGE.

WHEN Great Britain goes to war she is naturally bound first to guard her own coasts against the sudden inroads of a foreign fleet, before she ventures to attack the territories of hostile nations. It is, in fact, well known with what vigilance the shores of England were watched at the time of the First Empire, and what alarms were often caused by the mere phantom of an enemy's fleet appearing on the horizon. Since that time, thanks to a constant state of peace, the institution of the Coast-guard has been not so much intended to baffle the projects of invaders as to counteract the manœuvres of smugglers.

In consequence of the close vicinity of France, fraud

had begun to assume almost gigantic proportions on the other side of the Channel. What a mass of stories might be collected in Cornwall and elsewhere about these former smugglers, who at the present day can only be said to exist in legend! A respectable inhabitant on the coast found one morning in his cellars two hundred casks of brandy, of which, the evening before, he had no knowledge whatever. How could they have come there? A written notice enjoined him, with the most violent threats, not to breathe a word about it. Frightened to death, he closed the doors, swearing that he would not even see them. Some days after the casks had disappeared, with the exception of two or three tubs, which they had left to thank him for his silence. It was generally the case that the contraband goods, immediately after they were landed from the vessel, were buried in the sands or concealed in some deep cavern of difficult access, opening at the foot of the cliffs. The sale of merchandise not intended to pay duty was generally concluded some time beforehand; the great difficulty was to convey it into the interior of the country. Men used to make their way at night into the farmsteads, and take the horses out of the stables, harness them, and then convey their cargo in the farmers' waggons to some preconcerted spot. Horses, waggons, everything was afterwards faithfully and quietly returned; occasionally a present was added for the farmer's wife, such as a nice shawl or some lace.

The truth is, that the country population, without affording any material assistance to the contrabandists, gave countenance to them by a kind of moral complicity; they paid so generously for any service that was rendered them. Following this trade (for smuggling had really become almost a profession) was but little stain on a man's character. On the contrary, the prowess, the adventures, the warlike enterprises of these knights-errant of fraud tended rather to inflame the imagination and the heart of the softer sex. Sailors and fishermen willingly embarked in this unlawful commerce, and many a hardy fellow on the sea-coast displayed, in his encounters with the agents of Government, a courage well worthy of a better cause. The annual sum which was then lost to the State by the clandestine importation of French merchandise has been estimated at more than £800,000.

The public treasury has no great love for romance, especially when its interests suffer from it, and in spite of the general sympathy, more or less avowed, with the exploits of the smugglers, it resolved to maintain its rights with energy. In 1822, by a system of blockade, carried out by a fleet of fifty-two cruisers, they undertook to clear the Channel and the British seas from these terrible enemies of the English Custom-house. In two years (1822 and 1823) fifty-two vessels and three hundred and eighty boats, all engaged in contraband traffic, were captured on the coasts of the

United Kingdom. On land, the blockading force was composed of one thousand five hundred officers and seamen of the royal navy, and of a body of coast-guard men placed, at that time, under the control of the Board of Customs. The contest between the Treasury agents and the smugglers was a sharp one; acts of valour shone forth on both sides, better fitted to take a place in some great naval epic. Nevertheless, this *régime* of protection was ruinous to the country; it spent with one hand more than it saved with the other. In 1832, the expense to the State of the repression of a misdemeanour in which so many without scruple had a share, was estimated at more than £800,000. In the following year (1833) more than £181,000 were spent merely in constructing cottages for the officers and coast-guards on the sea-coast in Kent and Sussex.

Can we name the courage of the preventive force, real enough though it be, as the cause to which we must attribute the almost entire abolition of contraband trade among our neighbours? No, indeed: that which has put an end to the reign of the smugglers is the successive reductions in the duties on importation. Who, then, were in the wrong in former days, the Government or the contrabandists? Very probably both one and the other, as the fraud which was grafted on the unnaturally high tariffs has disappeared, never to return, from the very moment when a wiser and

more enlightened policy made the first decided step towards free trade. Swift was in the habit of saying that, in the arithmetical calculations of custom-house officers, two and two, instead of making *four*, often made only *one*. Why did he not also point out the means for correcting this false system of computation? Now the remedy is found, and is simply this—never to require from a country more than it is able and willing to pay. Free trade, by diminishing the expenses, has re-established the balance between the estimates and the receipts in the budget of the English Custom-house.

Since 1857 the coast-guards have passed under the orders of the Admiralty, instead of being superintended by the Board of Customs. At the present day, in order to be admitted into their ranks, a man must serve seven years at least in a ship-of-war, and be distinguished by his good conduct. Any candidate more than thirty-five years of age would find a difficulty in getting a recommendation from the naval authorities to the Lords Commissioners. At first sight there is but little in their appearance and uniform which distinguishes these coast-guardsmen from other sailors belonging to the royal navy. We find the same hard-featured face, on which the habitude of danger seems to have carved out a kind of stoical recklessness. With what an air of defiance will they brave the frowns of the contending elements or face

an enemy! The only difference is, that men-of-warsmen wear a large blue shirt-collar, bordered with a white edge, which, falling back freely over their shoulders, shows a naked and sinewy throat, bronzed with the sun and wind, while the seamen of the Preventive Service, when they are on duty, are clad in a loose jacket over a woollen shirt, with a narrow black silk neck-tie, and on a broad band encircling their hats the word "Coast-Guard" is written in letters of gold. To a leathern belt girt round their loins a cutlass is fastened, and in a kind of canvas pocket in front they thrust a pair of pistols. These arms, almost useless in the present day, at least will serve to recall to mind the time of contest and adventure, when these men or their predecessors had to vigorously defend their lives against the wolves of the sea. Some of them wear on their uniform two kinds of insignia,—the *chevrons*, or badges given for length of service, and the *good-conduct stripes*, awarded for meritorious behaviour. They can only obtain three of either kind; the first of these embroidered or silk bands, which they display so proudly on their arms, may be said to mean "good," the second "very good," and the third "excellent." Besides the honour, each of these marks of distinction has the advantage of adding a penny a day to the meagre pay of the coast-guardsman.

During the daytime they have little to do but walk about, with an old telescope in their hands, along a

certain portion of the shore, and follow with a vigilant glance all the ships and boats passing by the coast; but at night their duties are far more irksome. They are obliged to attend every morning at the coast-guard station-house, where they are informed as to what they will have to do after sunset. This station is generally a good-sized white house adjacent to the enclosure of cottages occupied by the coast-guardsmen; here also their arms and accoutrements are deposited. They all make it a point of honour to keep this place of rendezvous in a state of extraordinary neatness. A coast patrol is usually composed of seven men, one of whom looks out by day, and the other six watch during the hours of darkness. They are then formed into a patrol, and make their way along the sands or rocks to meet other parties, with whom they hold a parley, and to whom a message is communicated, so as to make sure that the duty is faithfully carried out. During the winter, when the skies and the sea both storm and rage, the lives of these men are exposed to many dangers. Five or six years ago, on a dark and tempestuous night, an officer who was on duty on the coast at Hunstanton, in Norfolk, lost sight of the path, which wound along on the edge of the overhanging cliff far above the sea, and was precipitated from a height of eighty feet down upon the rocks spread over the beach. Not a soul was aware of his fall; but, a few days after, some of his comrades, who had been

sent to search for him, found his mutilated remains. The same night another tragical accident took place at another part of the coast, and was equally fatal.

The coast-guard are, in fact, the sentinels whose duty it is to form a marine police day and night in the district under their charge. Against every ship or boat appearing at all suspicious, information is at once given to one station after another by means of the telegraph, which surrounds with its guardian zone the coasts of Great Britain. But as the decline in the contraband trade now affords to the agents of the Government but very few occasions for risking their lives, their zeal is now utilised in another way—that of saving life from shipwreck. It has been found very much easier to repress fiscal fraud than to do away with tempests, and it is the formidable treachery of the ocean that these men, known by the name of coast-guard boatmen, have chiefly to strive against. When they discover any vessel at sea, the crew of which show signals of distress, they are bound to be ready to afford succour to the shipwrecked men with all the blind fidelity of the Newfoundland dog. A boat is placed at every coast-guard station, into which they jump when any such need occurs, and immediately make their way to the vessel in danger.* The number of persons who are

* These boats and the coast-guard service must not be confounded with a very different institution which was the subject of my study in some former remarks. The coast-guardsmen in general have neither

thus saved from the jaws of death is estimated at 700 or 800 every year, and the property in peril from the sea which they wrest from shipwreck at about £700,000 to £800,000.

It is not, however, always with impunity that the brave sailors seek to baffle the gloomy confederacy of the elements, much more to be dreaded than any band of contrabandists. In 1859 four coast-guardsmen at Pevensey, on the coast of Sussex, received orders to launch their cutter and go to the assistance of a small vessel at about a mile from the shore, which seemed but little able to resist the force of the boiling waves. The sea was fearfully rough, and the danger was manifest; but the lieutenant had given the order, and the rules of discipline admitted of no objections; so they set off. A few minutes after the frail boat, tossed by the billows, was capsized about a hundred yards from the beach. The four brave seamen were soon seen clinging to the hull of the cutter, which was turned bottom upwards, and striving vigorously against the surf, but for want of cork belts they could not for any length of time make head against their too powerful enemy, and one by one disappeared for ever as the boat sank to the bottom. Catastrophes like these are not very rare. The

safety-belts nor cork appliances to keep them above water in case of accident, and as to their life-boat, it is very far from being constructed according to those rules of art which are a protection to the real life-boats against the fury of the waves.

coroner opens an inquest, the jury find a verdict of "accidentally drowned," a modest pension is awarded to the widows, the orphans are (some of them) very often adopted by the other boatmen, and then all is said and done. Fresh seamen, for whom perhaps the same fate is in store, take the place of those who had found a grave in the bosom of the ocean. One cannot help admiring such instances of true though obscure devotion, and wondering, also, how it is that a nation so jealous of its maritime glory does not seek to prevent, by some efficacious measures, such grievous sacrifices as these.

The coast-guard receive but a slender remuneration for the valuable amount of merchandise which they tear from the devouring appetite of the ocean. It is indeed true that, on the 1st of March every year, medals of two kinds are distributed by Government, one *of honour*, and another to which a gratuity is attached, for each of the men-of-war forming the centre, as it were, of a coast-guard district. Among the riches cast up by the sea which they are bound to collect and hand over to the proper authorities, these men often have to pick up the sad remains of shipwrecked victims. Lately, on the coast of Norfolk, the attention of the coast-guard was drawn to some object lying on the sand: it was the corpse of a woman!

Most of these men are lodged by Government, and when there are no residences for them an indemnity is paid of £5 a year. The cottages built on purpose for

the coast-guardsmen are composed of four rooms, two on the ground floor and two above, with a washhouse and offices generally detached from the main building. In front of the house there is a garden, in which the men cultivate their vegetables and the women dry their clean linen, which they have washed until it is as bright as snow. Behind, there is a small court-yard, paved with shingle stones taken from the beach. The coast-guardsmen appear extremely particular about this pebble work, and often inlay it with all kinds of patterns, like a mosaic. Love of home is a quality one would have hardly expected to find so strongly developed in these old sailors, who have passed their youth in wandering over the world in a man-of-war; but *Jack* (the common name in England for sailors) is distinguished by his love of domestic life. Whilst he is aboard ship he carries everywhere with him a little box he calls his *ditty-box*, in which he carefully stows away his letters and bosom secrets—such things as a faded ribbon or a lock of hair. Woe to the man who lays a profane hand on the hidden sanctuary of his affections! This *ditty-box*, this mysterious casket, is to him the germ of the fireside affections; when this germ subsequently grows into bloom, fostered by favourable circumstances and the sunshine of two dark eyes, this same man, once as much a wanderer as the shred of seaweed carried on the waves, firmly roots himself in the genial soil of home.

In fact, the whole *ménage* of these coast-guardsmen

offers to the visitor a pleasing model of comfort on a small scale. The chief point which distinguishes their homes is the pervading air of minute and charming neatness. On the threshold is spread a door-mat made from ship rope, woven by the industrious hands of the men themselves. In their little parlour, furnished simply, yet in good taste, everything in the way of wood or metal that can be made to shine is rubbed every morning with indefatigable energy. A carpet, muslin curtains, a table perfectly clean and covered with books, baskets full of flowers hung from the ceiling —such are the trifles which form the coquetry of these modest homes. The credit of such orderly arrangements is naturally due to the housewife; but in any case the English sailor is never at a loss; in case of need, he knows how to wash the linen, clean the house, and cook the victuals nearly or quite as well as his wife. The latter has often some avocation which she follows separately, as a sempstress, dressmaker, or milliner. She adds, by her industry, some few shillings every week to the meagre pay of her husband. We ought, though, to see her in the dark winter nights, when the wind howls like the shrieks of drowning men, and she is waiting, at her solitary fireside, the return of her absent husband. She gives up her rest to see that the kettle is hung over the hearth, to get ready a cup of tea to bring warmth into the benumbed limbs of the coast-guardsman. When he returns from his nightly

rounds, or from some life-saving enterprise, what joy she shows! The children, too, begin to wake up and give him welcome. Smiling at his little family, he sits down by the fire to dry his clothes, and gravely lights his comforting pipe.

These little groups of five or six cottages are generally surrounded by a boundary wall; there is also a piece of ground attached, often pretty considerable, which is cultivated as a kitchen-garden. In front this wall faces the sea, whilst the rest of the enclosure is bounded by the fields or unenclosed hills. A few paces from the cottages stands the station or watch-tower, whence the coast-guard watch the ocean during the daytime, and by the help of their telescopes embrace every detail on the horizon. These towers, built of brick, or sometimes even of wood, have nothing of the picturesque about them; when they are new they look very like dove-cotes, and when old they make but ugly ruins. These points of observation are, indeed, sometimes nothing but platforms, more or less crenelated, placed on the summit of a cliff. A kind of circle, surrounded by a balustrade, in the centre of which is reared up a lofty mast, flanked by two old pieces of artillery, serves in this case as the watch-tower.

The coast-guardsmen have occasionally to put off in their boats to overhaul any craft of suspicious appearance. This was at one time the most dangerous part of their duty. They often had to cope with men armed

to the teeth, half smugglers and half pirates, who had sworn to sell dearly to the agents of the public treasury the merchandise hidden away in the vessels under chase. The very women sometimes even took a part in these fraudulent though bold enterprises, and many a Cornish heroine has distinguished herself among her companions in arms in warm conflict with the coast-guard.

One of these men had allowed his heart to become entangled in the toils woven for him by the pretty face of a fisherman's daughter; she was beautiful, and though coy, had, nevertheless, after an assiduous court-ship of two years, promised to marry him. Their mar-riage was delayed for a few days by a circumstance which, at that time, was not at all unusual. For some time past a brigantine, which there was every reason to believe had been devoted to the contraband trade, had several times baffled the vigilance of the preven-tive officers. It seemed impossible to surprise her at sea during the night, whilst in the morning she was emptied and firmly moored in one of the little harbours on the coast. The coast-guard lover was directed, with some of his comrades, to give chase to the sus-pected vessel. This, however, was no easy task, for if it was occasionally seen like a black spot on the misty surface of the waves, the brigantine always escaped like a phantom just at the moment when they thought they were about to capture her. One night, however,

these look-out men distinctly perceived a sail swelling on the horizon before a strong west wind. They made sail in the same direction, and although the sky was dark enough to rejoice the heart even of a smuggler, there was not much delay in catching the fugitive vessel. The attack was made in due course; at the moment when they were about to board her, a shot, which they could see was fired by a cabin-boy, announced that the crew had made up their minds to defend themselves. The brigantine was taken after a smart resistance; but how great was the surprise of the assailants when, among the group of the subdued and depressed smugglers, they were unable to find the young man who had fired the pistol, whom, however, they had clearly made out by the light of the flash. In vain was he sought for in and about the vessel; but some days after the sea threw up on the beach, in one of the Cornish coves, the corpse of a female, dressed as a sailor, in whose face the coast-guardsman recognised the features of his intended. Had she fallen into the water by accident, or had she designedly buried in the waves the shame that awaited her, if she had been found by her lover in such evil company? This is a mystery which has never been cleared up.

Episodes of this kind are, at the present day, altogether unknown even on the wildest shores of the British Isles. The coast-guardsmen whom I have interrogated invariably tell me, "There are no ad-

ventures now." No one can very much regret this, except perhaps the English romance writer, who has thus lost a mine productive in interest. If we are to put any faith in reports, doubtless calumnious, the small amount of contraband trade which is at present carried on in England mostly passes through the hands of the agents of the Treasury. Is it not much the same with the gamekeepers, who are in certain cases the greatest poachers in the kingdom? God forbid, however, that we should easily accept accusations such as these, contradicted as they are by the honest faces, and simple manners of these old sailors—men accustomed to look death in the face, and to serve their country through all the horrors of the tempest!

The coast-guard of England, being under a strict military discipline, form at once both a fleet and an army. Their duty, which extends in turn both to land and sea, is, in fact, of an amphibious character. Their fleet consists of thirty-eight watch-vessels, a dozen guard-ships attached to the different districts, and forty-eight cruisers. To keep the *personnel* in good training, two men in succession are sent from each station to be re-dipped, as it were, in their former element, and to keep their hands in as regards the art of navigation. They go cruising along the shore, often as far as from the coast of Norfolk to the rocks of Scotland. These voyages last about six weeks, and each coast-guardsman must usually go once every year.

During the time they are away the wives remain alone in their cottages, counting the days in their uneasiness, and trembling at every storm of wind which bursts over the sea; for these coasts are dangerous, and many an experienced mariner has left his bones on them. The ships of the coast-guard, and the small vessels which they sometimes serve in, are occasionally collected in some seaport, and are reviewed by the Lords of the Admiralty.

A captain and a lieutenant, chosen from the royal navy, command a district, and are lodged at the expense of the Government. Each station placed under their orders is superintended by a *chief boatman*, who naturally occupies the best house in the enclosure belonging to the coast-guardsmen. These sub-officers are distinguished by having two letters, "C. G.," in brass on their caps, and the anchor-buttons on their blue jacket, and a crown embroidered in gold and scarlet on their left arm. After twenty years' service from the day when they entered the royal navy, a coast-guardsman, feeble either from age or sickness, is entitled to demand his retirement. He then, after an examination and favourable report from the medical officer, obtains a pension of £20 per annum. Nothing now prevents him from engaging in other occupations; but it is seldom that he can tear himself away from the sea, to which he is bound by so many ties. He generally likes to finish his days where

he can still set eyes on the vast waste of waters, where his ears can still catch the thousand ocean voices which recall to him the history of his youth.

The Admiralty presides over everything that concerns the royal navy; but it is also connected in many ways with the Trinity House, which exercises rights and functions of a somewhat similar character as regards the mercantile marine.* For the complete consideration of the latter, however, we must seek another theatre of action. Amidst the various docks of London we shall be best able to form some idea of the development of this second branch of maritime matters, grafted on the commerce and personal energy of the English. Besides, we must never forget that the merchant service has been the cradle of the royal navy, and that it is from among the courageous volunteers belonging to the class of merchant-seamen that the British naval power constantly recruits its forces.

* As to the origin and privileges of this eminently useful institution, my remarks in the *Revue des Deux Mondes*, September 1st, 1864, may be consulted.

CHAPTER VI.

THE PORT OF LONDON—THE DOCKS—WHEN AND WHY THEY WERE CONSTRUCTED—THE WEST INDIA DOCKS—THE EAST INDIA DOCKS—NAMES OF SHIPS—WHAT ARE THE FEMALE FIGURE-HEADS AT THE BOWS OF THE SHIPS?—THE LONDON DOCKS—ADVANTAGES OF THE SYSTEM TO LONDON MERCHANTS—THE VAULTS—SHERRY AND PORT—ORIGIN OF THE WORD "SACK"—WHY ENGLISHMEN DO NOT LIKE OUR FRENCH WINES—VEGETABLE STALACTITES—ARCHITECTURE OF THE VAULTS—THE "QUEEN'S TOBACCO PIPE"—WHAT IS SMOKED IN IT—SINGULAR EFFECT ON THE BRAIN PRODUCED BY A VISIT TO THE CELLARS—ST. KATHERINE'S DOCKS—COST OF THEIR CONSTRUCTION—SPECIAL POLICY WHICH DISTINGUISHED THEIR ORIGIN—THE DOCK WORKMEN—"MEN WANTED"—VICTORIA DOCKS—ENTRY AND DEPARTURE OF SHIPS—STATE OF COMMERCE IN ENGLAND—CAUSES FOR, AND DANGERS OF, HER PROSPERITY.

When King James I., irritated with the inhabitants of London, threatened to transfer his court to some other part of England, the Lord Mayor replied ironically, "We very much regret that you should intend to deprive us of your royal presence; but in the event of your Majesty withdrawing yourself from us, you would still leave us the Thames."

This river has, in fact, much more than any royal patronage, contributed to the commercial greatness of London, and to a foreigner what a spectacle does it present! Where else can we find such a thoroughfare of floating wealth? What is called the *Port of*

London extends from London Bridge as far as the North Foreland — a point of land jutting out into the Channel at the extremity of the Isle of Thanet. These, at least, were the limits assigned to it by Charles II.; but, in point of fact, the port, formed by the course of the river, does not extend below Gravesend.* Even within this distance there is a space of thirty-two miles covered with all the products of the known world. The ships at their moorings, ranged on both sides of the Thames, with their sails furled round the yards like great sea-birds with folded wings, are crowded close to one another in dense rows, and only the middle of the river is left for the stream of watery traffic. The dark and swelling flow of the noble river, subject as it is to the influence of the tides, brings up the vessels from the Channel, and conveys them back again to the ocean. Large ships, returned from a long voyage, advance slowly in the midst of a crowd of barges, steamboats, and brigs laden with corn or coals, and occasionally lie-to like great lords waiting

* We must not confuse the Port of London with what the English call the *River Jurisdiction of the City*; the latter extends from Staines, in Middlesex, to a boundary stone situated on the Essex shore. According to the ancient charter, the Corporation of the City of London was commissioned to superintend the management of the river, and the Lord Mayor bore the title of "Conservator of the Thames." A few years ago, Parliament took away from the corporation the privileges which they enjoyed with regard to the river and conferred them upon a council, of which the Lord Mayor is president.

their turn in a procession. Across this intricate tumult of vessels glide schooners with sails of every shape and colour, grey, brown, and patchwork, tacking about from shore to shore in among heavy iron-built ships towed by the active little steam-tugs, like whales drawn by dolphins. These floating masses cause a heavy swell on the surface of the water; and at a little distance in their foamy wake the light wherries dance about like grasshoppers of the sea, as they may be called. These are the boats of the watermen, a race at one time very numerous on the Thames, but which is now every day diminishing, in consequence of the steamboats doing the duty of ferry-boats, and conveying the passengers across from one bank to another. What a want of uniformity, but also what grandeur there is on all sides in the warehouses and massive buildings which hem in, both on the right and left, the majestic course of these troubled and busy waters! The moving iron funnels meet, as they pass on, the fixed chimneys of the factories; smoke, as it goes by, salutes smoke; navigation holds out to manufacture the hand of brotherhood.

On both banks of the river we notice at intervals the mouths of canals shut in by flood-gates or locks; these are the entrances to the docks, the vast extent of which one can hardly estimate with the eye, though they are marked out on the horizon by the forests of masts which tower over them. England has never

risked her treasures in greater and more useful undertakings than these docks. At first sight it seems as if the combined efforts of several generations would have been necessary to carry out works like these, but nevertheless these immense basins are all of modern date; our own century has witnessed their excavation.

Before the construction of the docks, the ships which entered the port of London had no other places at which to discharge their merchandise except the wharfs, some of which were called the *legal quays*, and some *sufferance wharfs*, stretching along the two banks of the river. These narrow platforms were heaped up with valuable goods, and on the other hand, the ships in the Thames had to complain of an organised system of piracy. Men crept into the vessels at night, and favoured by the darkness as well as by the confusion which necessarily prevailed among ships crowded so closely together, carried off some portion of their cargo. The amount that was thus lost every year by the commerce of London was estimated at £500,000. In 1793 a plan was proposed for preventing these robberies, and remedying the obstructions in the river. It was not, however, until more than six years later, in the month of August, 1802, that the *West India Docks* were opened for trade: these were the first works of the kind which had been constructed in the vicinity of London.

These docks were established at the enormous cost

of £1,380,000, and extend across the isthmus which joins the Isle of Dogs, by the side of the Thames, about four or five miles from the City. The whole extent of them is surrounded by a high and thick wall, intended to protect the vessels laden with goods against any nocturnal depredators. Like all works of the same character, they consist of three distinct elements,—the basins, the quays, and the warehouses. The advantage of these basins is, that being always filled with an equal quantity of still water, the vessels are sheltered from the rise and fall of the tide. Formerly large ships in process of unloading close to the bank were compelled to haul off into the stream at the ebb of the tide. Nothing, in fact, does so much to strain a large ship, especially when she is laden, as lying high and dry on the strand. Now-a-days these floating masses repose at their ease in their native element, without troubling about the ebb and flow of the tide. As the keel never touches the ground, vessels now have no cause for suffering from chafing on the hard shore. The success of the docks is easily explained if we only reflect a little on the value of these wooden houses, and the benefits which are conferred on them by these modern constructions. The quays intended to replace the former wharfs are vast granite jetties, on which is proudly spread out the merchandise, unloaded from the vessels, or about to be shipped. Every ship has its place marked, and even numbered, on a stone on

these wide esplanades. As to the warehouses, they are immense brick buildings, with windows closed with shutters or provided with rusty iron bars; their walls bristle with cranes and pulleys, which, by means of chains armed with hooks, lay hold of the heavy bales and casks placed on the ground, and convey them to the upper floors of the edifice. It is curious to see these ponderous loads supported by the hooks which grapple them, dancing like *marionnettes* at the end of a string.

One portion of these docks is devoted to the importation, and another to the exportation, of goods, and this arrangement very much facilitates commercial transactions. Merchandise imported from distant countries, or which is the product of the manufactories of Great Britain, changes hands and passes from one *entrepôt* to the other, by virtue of a simple piece of paper, known under the name of a *dock-warrant*, which is afterwards looked upon in the business-world as one of the most certain documents of security that can be offered. The authority of the Dock Company guarantees also to some extent to the buyer the quality as well as the exact quantity of the goods sold. For a long time the warehouses in these docks were filled almost exclusively by the products of the West Indies, —such as rum, sugar, coffee, and mahogany. In fact, a clause in the Act of Incorporation compelled all vessels laden with the wealth of these colonies to make use of the basins constructed for this purpose. This

monopoly, which was granted for twenty-one years only, now no longer exists, and these docks are at present open to vessels carrying on trade with every part of the globe. The original stamp, with which they were impressed by the company of rich merchants trading with the West Indies, is not, however, entirely effaced. These are still the docks which we must visit if one wishes to inhale, in their produce, the perfumes of the group of islands which has been called the terrestrial paradise of the New World.

"The East India Docks, made in 1804 to 1806, in the reign of George III., are situate at a very short distance from their West India compeers, and in the same district of Blackwall, which is now become one of the maritime quarters of London. Their walled-in enclosure is entered through a massive stone arch supported on heavy columns, and surmounted by an historical inscription. A black tablet inside points out the names of the newly-arrived vessels, as well as the jetty, quay, or basin where each may be found. One ought to know that these docks are like a town, and that without some information of this sort, a ship would be almost as difficult to find as the address of a merchant in certain parts of London. The line of quays is bounded on one side by the basins overtopped by masts, and on the other by sheds intended to receive the merchandise. These warehouses, which follow one another in succession, are built of wood, with tiled roofs,

and are lighted by loopholes at intervals. In each room the cases or bales are ranged right and left in admirable order, a gangway being left open down the middle for the labourers. Behind these sheds there is another range of warehouses, solidly built of brick, and closed in with iron doors.* The words "export" or "import," written in black letters, sufficiently indicate the two great divisions of these *dépôts*, and it is certainly very curious to compare the different sorts of merchandise which we see in them. The kind of goods that are *imported* are generally in the shape of raw material, such as buffalo-horns, indigo, raw silk, and spices; in those that are *exported*, on the contrary, who could fail to recognise at the first glance the features of manufactures and labour? They consist of spades, ploughs, furniture, and utensils destined to rejoice the domestic hearth. Side by side with the gifts of nature, we see the human power which fashions them into shape, and the hand which converts them into tools for increasing the comfort of the family and the productiveness of the earth.

A walk through the docks forms an excellent lesson

* The last time that I visited the East India Docks, some of these buildings had just been destroyed by fire, and they were then being rebuilt. Eighteen thousand bales of jute had been consumed or damaged by the flames. The effects of the scourge could still be traced on the surface of the ground strewed with ruins, and covered with great black stains. Since 1838, the East and West India Docks have both been united under one company.

in both political economy and history. Various races are there represented by the character of their products; but the difficulty is to keep one's attention alive in the midst of a perpetual coming and going of small trucks laden with merchandise running on iron wheels, and every moment interfering with the legs of the passers-by. Here everything and everybody is at work, and even the inanimate agents take a living form. Cranes, with their foundations bedded in the stone, stretch out their long necks, and at the end of their beaks hold out sacks filled with biscuit to the ships getting ready to sail. Occasionally we have to cross from one basin to another, on the ledges of the barriers which are used to keep back the water: these act as both draw-bridges and lock-gates. We thus plunge again into quite new quarters of the docks,—avenue opening behind avenue, where men are gravely seated before tables placed in the open air, entering the details of goods in account-books. In the meantime one o'clock strikes on the great clock of the docks; the manual labour is suspended, groups of workmen, clad in white canvas frocks and corduroy trousers, are making their way towards the entrance-gate to go out to get their dinners. We will profit by their absence and the comparative solitude of the quays, and take the opportunity to examine the vessels.

The artificial basins of the East India Dock, being intended to take in very large ships, has in no part

a less depth than twenty-three feet of water, in which vessels of every shape and every country peacefully float. The English manifest a great admiration for these buoyant machines, most of which have come out of their own building-yards, and no person can be long among our neighbours without easily catching some portion of the enthusiasm with which naval architecture inspires them. The lofty masts in their tranquillity, the fine tracery of the rigging, the enormous cables rolled up like the coils of a serpent, the long slender hulls of some of the steamers, covered with iron or copper,—everything here seems to breathe a sentiment of poetry, grand like the sea. What a conscious pride there is in the imposing bulk of these vessels, which have also discovered the secret of making themselves both light and rapid! With what skill does man communicate to these monsters of ingenuity the properties—nay, even, as it were, the generous spirit—of the beings who float on the surface of the ocean! Down below, some of these ships are like sailing-palaces, with saloons fitted up in rosewood or maple, magnificent services of plate, and all the elegancies of Asiatic luxury. I was also much interested in the various names of the ships, and the carved figure-heads which they carry so proudly at their bows.

To the English sailor his ship is a *person;* its name is not only a mark of identity, but represents to him a reasonable being, with whose destiny that of the

crew is closely bound up. A good many of them have received the names of the countries they visit. Here, for instance, is the *Indus*, with an image representing the river of that name; the *Maori*, ornamented with a statue of a native holding a spear in his hand, and clad in a red mantle; the *Dilharree*, just about to sail for Bombay, which shows at her bows the effigy of a handsome black woman. The English sailor does not seem unacquainted with the history of antiquity, and he rather loves classic reminiscences; we may conclude this by the *Ulysses*,—his head covered with a blue helmet, and the body clad in a coat of mail, over which floats a red scarf, with his arm raised to threaten his enemies. A little way off I noticed also the *Centurion*, a vessel of heavy tonnage, which is personified by a Roman warrior armed cap-a-pie.

Mythology and allegory are very much preferred by *Jack* to any historical delineations. He is, for instance, much taken by the emblem of Jason, his spear in one hand, the golden fleece in the other, and the dragon under his feet. Sometimes his ideal floats in uncertainty between fabulous and Christian mythology. Notice the figure-head of the *Calcutta*, in which flesh-coloured angels are associated with a centaur holding Medusa's head as a shield. Perhaps the favourite imagery of navigation is borrowed in many cases from the race of fairies, water genii, and naiads. What seductive sirens some of them look with their denuded bosoms! Where is the *Water Nymph* bound

to—a young girl crowned with the leaves of the water-lily, a blue scarf round her shoulders, and a gilt urn in her hand? A placard tells us that she will very soon leave the docks for New Zealand. With what a defiant air does the emblem of the *Conflict* rear himself, a shield in one hand and a trident in the other! The genius and literature of the day also take a share in furnishing types for nautical sculpture. Thus it is that the heroes and heroines of Sir Walter Scott, Byron, and Moore; certain political celebrities, such as John Bright; famed *artistes* in singing and dancing; and angels of charity like Florence Nightingale, frequently have the honour of leading the way over the sea for vessels of which they form certainly the most prominent and conspicuous portion.

Oftener still does the nautical man, in choosing his *figure-head*, consult the feelings of his heart; he gives his ship the name of her whom he loves, and enriches it with a wooden statue, more or less gilded and painted, which is the portrait of his ideal of womankind. We may very likely consider his ideal as a rather coarse and material one; but each has his own peculiar type of beauty. *Jack's* type is, in general, a strong hearty girl, with regular features and brilliant complexion; for that which is most esteemed in woman by the swarthy and sun-burnt mariner is freshness in her looks. As the sculptors employed in this sort of work are essentially realists, they scrupulously copy the fashions which they have before

their eyes; the result, therefore, is, that after a few years the costume of these sea-brides is not at all in accordance with the taste of the new generation rising up. Just when I was engaged in looking at an antiquated figure-head of a female dressed in a tight-fitting gown with flounces, a young sailor who passed near me could not help remarking, "A fine woman! she really only wants a little crinoline." These wooden statues, bent forward as they are in the bows of the ship, generally lose their arms in the conflict they have to sustain against the winds and waves during the course of their many voyages. These idols, if we may so call them, hallowed by loving reminiscences, and in which the sailors in some cases place a kind of superstitious reliance, have then a very dismantled look; but still every hand in the crew would be lifted up to defend them. Woe be to him who would insult these emblems! Any way, we cannot help admiring the delicate attention of the sailor who, not being able to bring his flesh-and-blood beauty on board with him, at least carries about her effigy at the bows of his ship.

There is, however, but little need to go away from the heart of London to find other great theatres of nautical and mercantile energy. In 1805 the London Docks were opened, situated between Wapping and Shadwell: they were intended to take in vessels laden with wine, brandy, tobacco, rice, &c. As the ground was much dearer to buy in the town than in the

country, the London Docks are distinguished by what the English call their compact character. The ships are here crowded so closely together, that it is with difficulty we can catch a sight of the dark and stagnant water. The warehouses tower up like castles, and they are often glutted with merchandise. The difficulty sometimes is to find a path along the quays among the walls of cotton-bales just landed. What an obstruction of exotic produce! One is not so over-astonished at seeing them piling heap on heap of objects of the very first necessity, such as sugar and coffee; but to any one who is not familiarised with the world of commerce, it would certainly be difficult to restrain a sensation of surprise at the accumulation of certain drugs. Who will ever absorb those eighteen hundred casks of aloes? If you are fond of nutmegs, there are enough here to frighten even Boileau's *Amphitryon*. If cinnamon is your preference, eight thousand bales are imported here every year. In some of these warehouses the visitor often walks amid wealth of which he forms but a very slight idea. Who would believe that these rough-looking cast-iron bottles, ranged on the floor of a securely-locked room, represent a fortune? They are all full of quicksilver, and the value of this liquid metal is pretty well known.

One great advantage of these warehouses, in a commercial point of view, is that, being placed under the inspection of the Custom-house officers, the merchant

is not compelled, as he used often to be, to pay the duties at the moment the goods are landed. As long as the merchandise remains in the *entrepôts*, and does not depreciate in value, it answers for itself both to the Customs and also to the Dock Company, for their charges. A great portion of the labour is facilitated by the use of machinery. Hydraulic lifts, constructed of wood, which ascend or descend at will, raise the loads up to the loophole of the warehouse intended to receive them. When these moving staircases are required, call for them pretty loudly, and they make their appearance. I myself went up and down from floor to floor without even moving my legs. Among all these immense warehouses, the one that most excited my admiration is the tobacco *dépôt*, covering by itself an extent of nearly five acres. High four-storied brick buildings succeed one another in a line along a quay quite covered with hogsheads. At the bottom of this *façade*, and on a level with the pavement, archways open at intervals, through which one seems to plunge into obscurity. These are the entrances to the vaults.

As I held a letter of introduction, not only to visit the cellars, but also to taste two sorts of wine, I stopped in front of the arch bearing the number 5. This was the one pointed out on my card. One of the cellarmen lighted two lamps attached to long wooden handles, one of which he handed me, and then made it his business to conduct me. The cellar which I entered

contained by itself twenty thousand casks of wine, and it was by no means the largest; this fact I was made quite sure of when I saw the very same day the East Crescent Vaults. Who was it thanked God that there was no wine in England? I must, however, confess that the wines which they prefer are not those of our country. Englishmen do not sufficiently appreciate our French wines; they find them poor and acid. A feeling for national honour compels me to believe that in this respect their taste is a false one, and it would indeed be easy for me to adduce proof of this.

Numerous historical records attest that the produce of our vineyards was at one time much esteemed across the Channel, and held a high place at the table of the rich. This was the case until after the wars of Louis XIV., that is, about 1693. William III., of England, who certainly had many good reasons for revenging himself on France, wished at that time to punish her through her commerce, and through one of the most flourishing branches of her agricultural industry; he therefore laid an exceptional and prohibitory import duty on our wines. This had the effect of closing the markets to them on the other side of the Channel, and the English were compelled to seek elsewhere another source of supply. As regards red wines, they gave the preference to that of Oporto; not that it was in reality better than ours, but because, after the treaty of Methuen, concluded with Portugal in 1703 it was

favoured in the duties. It is true that since then the tariffs of the English Customs were equalised in 1831, and have been gradually reduced for all foreign wines: the only thing was, this freedom came too late; the bent to the taste had been given, and the palates of our good neighbours had been educated to another relish than that for our growths. Whether the fault be laid to Louis XIV., or to William III., the fact remains the same,—the fashion has to be reset, and the recent treaty of commerce will have to contend, for many years, perhaps, as regards French wines, with a taste strengthened as it is by the customs of more than two centuries. The plan, too, which the English adopt in their table arrangements, is not a very favourable one to the quality of our produce; they drink but little until after the meal, and then need wines of strength, which replace the *liqueurs* used by us.

My guide led me in succession to two butts, one of port the other of sherry, both of which were most assuredly excellent of their kind. The former is grown on the banks of the Douro, about fifty miles from the town from which it gets its name, where also it is laden into the ships. The great market for it is in England, although it also travels as far as the New World. It is red and dark in colour, and is the real *blood* of the Portuguese vine. The second—that is, the sherry—is made in the province of Cadiz, between the Guadalquivir and the Guadaleta rivers. The district over

which the vines extend forms a sort of triangle, of which Xeres de la Frontera occupies one of the points. This wine varies from a very pale to a brown colour; but it is an axiom among connoisseurs in England that one must never judge of wine by the colour. The age, the growth, the names of the producer and of the merchant—these form its true patent of nobility.

When I was handing back to the cellarman the glass which I had just emptied of the precious liquor, a discussion arose between two gentlemen close by us. As the subject of their conversation was of a nature that interested me, and as there was nothing in it of a private nature, I listened to it. For a long time the white wines of Andalusia, as well, no doubt, as those from the Canaries, were designated in England by the name of *sack*. We often meet with this word in the poets of the Elizabethan age, and especially in Shakspeare. Walter Scott, also, several times makes use of it to indicate the wine of Xeres (or sherry). It was as to the origin of this word that the two adversaries were debating with all the science of English etymologists. One of them maintained that the word *sack* came from our French word *sec*, and in this case served to point out the quality of a wine divested of its original insipidity. The other, on the contrary, would have it that the English name was derived from the Spanish word *saca*, in allusion to the goat-skins in which this liquor used to be kept. There was, however, one difficulty in this last

explanation; this was, that the leathern bottle in which the Spaniards place their white wine is not called, in their language, *saca*, but *odre*. Not being able to agree, the two Englishmen formed the idea of choosing me as an umpire between them, doubtless because I was a foreigner. They made but a bad hit in selecting me, for I felt in no way fitted for my part; however, I decided against both of them. It appears, in fact, to me, that the word is neither French nor Spanish, but English. The merchants of Great Britain must, in old times, have necessarily been struck with the shape and nature of the skins in which the wines of Andalusia at first reached them. Then, by designating the contents by the thing containing them, they called this liquor *sack*, from a word which had long previously existed in their language, and was applied to certain receptacles for goods. It is just as if they had called it "wine in sacks."

My *cicerone* had, however, easily seen, by my way of tasting the sherry, that I was not a connoisseur in wine, and supposing, therefore, that my visit was one of curiosity, he offered to show me over the whole of the vaults. This was just what I wished. We made our way along avenues flanked by walls of butts. Granite pillars and low-vaulted arches follow and cross one another, dimly seen in the darkness, and are lost to the view in an indistinct mass of obscurity. This style of architecture, although rude and simple, very much recalls to mind

the crypts we meet with in ancient cathedrals. The most remarkable feature, however, here is the gloomy-looking vegetation which covers the roof in these dark galleries. A pulpy and blackish matter, presenting the most varied patterns, is constantly growing on the surface of the stones or bricks. When it is touched it is like tinder, and often appears covered with a kind of white froth which melts away under the fingers. The *employés* in the docks seem extremely proud of these natural arabesques, and never allow any one to destroy them. According to their ideas it is a proof of the excellence of the cellars. The most singular thing about it is, that vegetable incrustations of this sort are never found except in vaults devoted to the storage of wine. Some of these large fungoid masses hung above our heads in long stalactites, covered at the ends with a cottony substance. We walked among these pendent festoons, and, as we sometimes came in contact with them, pushed them away with the hand; but, notwithstanding they appeared so solid, they waved about in the air like spiders'-webs in the breeze.

At intervals along our path we found large lamps, made round like a bull's-eye, which, however, were quite unable to overcome the obscurity which prevailed under the arches of these catacombs. Groups of lights, some fixed and some moving about, might sometimes be discovered at a distance: these misty stars showed that work was going on there, though we could see but little

of the labourers. The flat and even floor on which we walked was everywhere covered with a layer of saw-dust; I am sorry that I do not recollect how many thousands of bushels of it are spread about every week. The tramways for the hand trucks on which the butts are moved wind about in every direction, and the length covered by these intricate iron ribbons is estimated at thirty-six English miles. We had now arrived in the main subterranean avenue, bordered on each side by a perfect forest of pillars; there is a thermometer here, which the superintendent consults three times a day. It is well known that equality of temperature exercises a very favourable influence on the condition of wines, and the climate of these cellars does not vary more than two degrees between summer and winter. At the bottom of one of the dark transepts which branch off from the principal nave, I noticed the first window I had seen communicating with the open air. As the outside wall in which this opening is made is twelve feet thick, one may easily judge that the twilight making its way through this mass of stone was but very feeble; it was just enough to make one long for the light of the sun.

Many men, both young and old, the gnomes, as it were, of these wine-seasoned shades, pass nearly all their day in these vaults. Their life may be said to be composed of *two nights*, one in which they work, and one in which they sleep. Keeping on our way, my guide

drew my attention to a kind of tower of masonry, which rises up through the vault, the base of which sinks deep into the earth, and the upper part is lost to view above us. This tower, which, after all, is nothing but a brick chimney, enjoys a certain celebrity in England under the name of the *Queen's tobacco-pipe.* It is, in fact, the furnace in which, by order of the Customs, they burn damaged goods, such as tobacco and tea. If I may put faith in some rather weighty testimony, this *Queen's pipe* makes many a person jealous. There are plenty of poor families who would be glad of the articles which are consumed in it; and although the goods may be damaged, poverty might be able to draw pleasure and support from them. At the time when I visited the London Docks, the sacrificial smoke had not gone up for some weeks past.

The value of each of the butts of wine is estimated to be about £70 on the average, and as there are twenty thousand of them in only one of the cellars, an idea can easily be formed of the wealth which is stored in all these crypts together, extending, as they do, over a space of eighteen acres.* Every butt bears some hieroglyphic marks showing the name of its proprietor, the year of its growth, the date of its arrival in the docks, and the name of the ship in which it was imported. Some of these casks appeared covered with specimens of the fungus tribe and other vegetable

* The brandy vaults are able to contain 36,000 casks.

growths, all more or less of the same nature as the nocturnal *flora* on the roofs of the vaults. These are, however, the honourable certificates of age, and they would certainly take care not to destroy them. Each butt pays the Dock Company lodging money, as it were, of fourpence a week, and a smaller cask twopence a week. This charge is certainly rather high, and some rich wine-merchants, well known in London, disburse a considerable sum every year for nothing but rent for their goods. But it must be confessed that, in consideration for this periodical charge, they are disembarrassed of a great deal of trouble; their wines are kept, taken care of, and watched in magnificent cellars, where they can go themselves and inspect them whenever they have a mind.

There is also another advantage—they are not compelled to pay the Customs duties so long as the wines remain in the docks. This last consideration appears to be the one that has most contributed to the development among our neighbours of the dock system. Every one knows how slowly the wines of Spain and Portugal come to maturity. They have to be kept in the wood for years after their arrival; it is the only way to get rid of the defects of their youth. As the English—it is only doing them justice to say—know pretty well how to calculate, they reckon that the money they would have to pay into the hands of the Customs immediately after landing the wines is much

better deposited in their own pockets than in the State treasury. All the time that the wine is getting age and improving in value in the shades of the docks, it pays nothing to the Customs. The merchant is thus enabled to dispose of the funds which would otherwise revert to Government, and to make them fructify in other enterprises up to the day when he can get rid of his dormant merchandise to good advantage. The reduction of the import duties will, perhaps, sooner or later in some respects much modify the habits of English commerce, but at present the constantly increasing prosperity of the docks seems to defy the lowering of tariffs.

I emerged from the cellars in rather a singular state. The ships appeared to me to be dancing about in the basins; the warehouses were turning round and round like windmills. I then recollected that I had heard Englishmen tell more than one sad or ridiculous story about the effects of the intoxication which is developed in some brains by the air of these cellars, filled as they are with the fumes of wine. The *employés* themselves who have to deal with the perfidious liquor in these places, although generally sober and temperate men, very soon contract an expression of countenance which reminds one of the mask of Silenus. I certainly felt hardly able to walk, and my ideas were all running wild. These unpleasant sensations were not very long in disappearing, thanks to moving about in the open air. It

was well it was so, for I had still, that same day, to visit the St. Katherine's Docks.

These docks are closely adjacent to the former, and, surrounded with a high wall running the whole length of Nightingale Lane, extend to the corner of the open ground on which stands the Tower of London. Of all the establishments of this kind, these have been the most expensive in construction. In 1823 a wealthy company of merchants applied to the English Parliament for authority to commence making them. On a portion of the ground which it was proposed to buy a hospital then stood, St. Katherine's Hospital; it therefore became necessary to treat with the master and brethren of this charitable institution. They consented to move their location in consideration of a considerable indemnity, and an edifice of the same name was built for them at the east side of the Regent's Park, where it still stands. This was not the only obstacle that had to be overcome; 1,250 houses had to be pulled down, and 11,350 inhabitants had to be evicted. Telfourd, the celebrated engineer, and Hardwick, as architect, had the direction of the works. The most difficult part of the job was digging out the very hard soil, and then getting rid of the excavated earth. It was after all carried along the Thames to Millbank, where there were at that time some old reservoirs which needed filling up. So one basin served to do away with another.

The St. Katherine's Docks are the only docks where the vessels are able to enter and go out during the night. The warehouses are mostly built on pillars, and the ground floor forms a covered gallery like cloisters, under which goods are discharged, and the labourers can work sheltered from the weather. The characteristic, however, which most recommends these docks to the attention of the economist is, that they were the first of all these institutions to substitute a system of free trade for one of monopoly. The first establishments of the kind compelled all those vessels to enter their basins which traded with certain countries, or were laden with certain goods; but the St. Katherine's Dock Company left their fortunes entirely to the choice and convenience of the ship-owners. This latter principle is the one that has always triumphed among our neighbours, and as the old privileges expired with the lapse of time, Parliament refused to renew them.

But what are all these men doing, clad in the garb of poverty, who crowd at the entrance of the two docks, both the London and St. Katherine's? Pale and motionless, like statues of Hunger, they stand about there all day, from morning to evening, in every season of the year. Their looks indicate only a sort of vague anxiety, and the bitter feeling of hopes too often deceived. These poor men are all waiting for work. The dock service employs regularly a very large number

of workmen, such as porters, unloaders, and labourers generally; but it occasionally happens, when work presses, that they have recourse to what the English, in rather contemptuous language, call "extra hands." It is this chance that the London *Bohemians* count on, and they are thus induced to form a dark group of idlers, often overflowing the foot pavement round the dock-gates. These gates are among the last resorts of London poverty. Thither day by day, and month by month, resort the victims of intemperance, ignorance, or perhaps only of a combination of unhappy circumstances. A curious feature in these entirely destitute men is their patience, and their dogged faith in this lottery for their daily bread. The work in the docks certainly has one point of attraction for these poor fellows, that it does not require any great skill, or apprenticeship, but only mere strength of arms. The saddest thing about it is—and I have been assured of the fact—that many of them are men of education, and have even held some rank in society; they cannot have made up their minds to this sorry calling of expectant labour without having fathomed to its utmost depth the abyss of misery. In London it is always the gentlemen who fall the very lowest, when they do fall.

The anxious waiting of the groups stationed round the dock entrance is, however, sometimes crowned with success. "Men wanted" is shouted out in a loud voice from the interior of the sacred enclosure, for-

bidden to the idlers of the street. It is curious to notice the almost electric shock which is produced among these statues by the above words. The whole band darts forward with a single bound; alas! it too often happens that they only require about a dozen auxiliaries, and there are more than a hundred candidates. After a contest and tumult, lasting perhaps some minutes, the group resumes its glacial immobility. Nothing seems to discourage these labourers, living, as it were, upon chance. Death, sickness, prisons, and other causes, constantly make gaps in their ranks, but others soon hasten to fill their places. And the spectre of Hunger is always there—mute, ragged, pale, hoping against hope—he besets with proffered services the entrance-gates of warehouses where the riches of the world are heaped up. One cannot help feeling interested in these men. True, they beg, but they only beg for work. Poverty, compulsorily idle at the gates of the great *dépôts* where navigation is incessantly depositing the elements of the nation's wealth—what a striking and bitter contrast!

The cause which brought the docks into the very heart of London was naturally the facility for disposing of the merchandise, and of immediately transmitting it to its destination. This advantage is now-a-days very much neutralised by the increased rapidity in means of transport, thanks to the new agent which does away with the question of distance. Thus, in

1850, an application was made to Parliament for authority to construct the Victoria Docks, eight or ten miles from London, in the former marshes at Plaistow, facing a creek formed by the course of the Thames. Nature herself had to some extent facilitated the work, and although these docks are on a much more extensive scale than the others in and close to London, they cost very much less in construction. The whole expenses of the company did not reach to above a million sterling. In order to visit the Victoria Docks, I went by water to Blackwall, whence an old tug doing duty as a steamboat brought me to the entrance of a canal opening into the Thames. What I was most struck with at first sight was the extent of the view round me. Some of the largest frigates of the English fleet lie moored at their ease in these immense basins, as if in a quiet lake; among them, for instance, is the *Northumberland*, a formidable mass of iron surmounted by five masts, and all studded with invisible cannon. One of the characteristics of these new iron-clad engines of warfare is really the hypocrisy with which they disguise their means of attack. They might be well called monsters which hide their teeth.

It is, however, only by chance, as it were, and with a view of completing their armament, that war-vessels sometimes take up their quarters in the waters devoted to the peaceful needs of commerce. The West India mail boats, large Russian vessels, ships laden with

logwood, and other articles of commerce which are called *bulky* by the English, these are the more frequent *habitués* of the Victoria Docks. Everything here reminds one of the sea, and yet a collection of birds belonging more to river banks gives a kind of charm to the *ensemble* of nautical labours. How gracefully the pigeons in their heavy flight settle on the rigging of the ships! The basins are edged by six large stone jetties, on which stand some large warehouses. There are sheds which are able to contain as much as 100,000 tons of guano, and the Victoria Docks are now the only place where they land this natural manure. But the system of loading and unloading here still more deserves our attention. A branch of the Eastern Counties Railway runs in a straight line right into the interior of the docks. The trucks can thus come close up to the basins where the steamships lie with their cargoes on their return from sea, or just ready to sail on a fresh voyage. In this way the transit of the merchandise from the water to the land, and *vice versâ*, is nothing but a short change between two impulses of steam. This branch of the Eastern Counties Railway communicates, besides, with all the other railways in the kingdom, and once set in motion, the commodities need not stop, or be shifted from the trucks they are in, until they arrive at their journey's end.

Another interesting scene is the arrival and departure

of ships. It was the detail of departure that I was enabled to observe. Two steamships, the *Laurent* and the *Medora*, were to take leave of the docks that very day to sail for Canada. A black placard announced that the event would take place at three o'clock. They were already full of merchandise between decks, and the passengers—men, women, and children—were climbing with difficulty, and step by step, up the rough rope-ladders hung along the side of the ships. The boiler fires were lighted, the funnels were smoking, the steam was hissing, and nevertheless there was yet no motion. The *Laurent* and the *Medora* were two fine screw-ships, but one would hardly fancy what an utter helplessness and inability of movement these floating masses manifest in the confined waters of the basin. What advantage do they derive from their power if they are not in a position to make use of it? It is necessary to haul them out by means of cables, which are gradually rolled round huge iron capstans by an hydraulic process. It is water, in fact, which, compressed by certain contrivances, is the principal and invisible agent of the great automatic labours executed with the help of machinery. Ships—those machines assisted by machines—are thus enabled to supplement the energy in which for the time they are deficient. But there are still several obstacles which oppose the passage of the two steamships, helped though they be by the above appliances: among other things there is

a massive iron bridge, over which carriages are now rolling. There is no need for anxiety; in the docks obstacles give way, and are removed of their own accord by means of concealed mechanical combinations. The bridge turned round on one of its axes as if by magic, and left the passage free. There was now no impediment except the lock-gates, in front of which both the departing ships stopped for a short time one after another. Some friends who had gone on board to bid adieu to the passengers now descended the rope-ladder. All this time the gates which keep back the water were being opened by levers, concealed from the gaze of the inquisitive. It was necessary to wait a short time until the level of the water was the same in the dock basins and in the narrow canal opening into the Thames. Next, two tug-boats, small, but strong and active as electric eels, place themselves in front of each of the two steamers, and tow them with singular power down the river. Like giants recovering their torpid energies, the *Laurent* and the *Medora* appeared to wake up under the influence of the wider waters. They executed some manœuvres, and then went away into the distance, whilst a group of persons on the land, still following them with their eyes, waved their white handkerchiefs by way of a parting salute.

The London, St. Katherine, and Victoria Docks have been lately combined under the same company. It is the grandest enterprise of the kind existing in the

world.* Its capital stock is formed by shares, and it is governed by a Board of Directors, who, being mostly merchants themselves, have a personal interest in reducing as much as possible the dock charges on imported and exported goods. At all events, from the 1st of January to the 30th of June, 1866, the net profits amounted to £178,929. The head-offices are in Leadenhall Street, and occupy one of the fine buildings which glorify the City of London. No one can fail to recognise the services which the construction of the docks has rendered to English commerce. Being surrounded by walls and submitted to an active supervision, they have thus guarded the goods from a system of pillage, accelerated the loading and unloading of cargoes, and facilitated the classification and sale of the produce. Another advantage is especially due to them—that they have brought business matters closer together by concentrating in one system navigation, railways, and the telegraph.

Every six months Englishmen ascertain with a kind of rapture the increasingly rapid augmentation of their revenue. Among the causes which contribute to this incredible prosperity there are certainly some of which our neighbours have good reason to feel proud: their free institutions, the practical participation of the middle-classes in political matters, the extent and inde-

* In the month of June, 1866, this company reckoned its assets at the enormous sum of £9,252,549.

pendence of their mercantile marine, well accustomed as it is to reckon on its own energy only,—all these are fair subjects for exultation. This increase in the nation's wealth is doubtless a sign of strength. The time is now gone by when Sparta could plume herself on her indifference to riches and her iron money. A country which, like Great Britain, depends on navigation and commerce as the constituents of her industry, has good need of money. She needs it to give life to the promotion of useful works, to diffuse instruction among the working classes, and to diminish the causes of pauperism. It may be, however, well to warn the English that the development of wealth is not the only gauge of national greatness. The rank of a community in the scale of modern civilisation can hardly now be measured solely by the number of tons that it exports. When one sees the docks heaped up with produce, when one stands amidst the cotton-bales on which sits softly enthroned the genius of Speculation and Commerce, there certainly seems but little reason to dread that England's resources are declining. There is, on the contrary, more reason to fear that she is prospering only too much, and that, amid a commercial opulence unequalled in the world's history, she may lose sight of the interests of the mind in her concerns for those of matter.

The true power of a nation lies in the enlightened protection which it affords to every generous cause. Let Great Britain consult her own history, and she will

be compelled to confess that in times when her finances were much less flourishing, she perhaps filled a higher position in the councils of Europe. Is not this inaction caused by the complacent feeling which the present state of her affairs inspires? Is not the quiescent calm of comfort the sure source of peril to every commercial people? Surely it must be in vain that peace is sought for from selfishness. With nations, just as with individuals, the day must come when the spirit takes its revenge for the exuberant triumphs of matter. Ideas may be talked down, and perhaps be smothered for a time under the pressure of pecuniary interests; but they will still go on fermenting in the inmost recesses of the community. Great Britain is beginning to see something of this, agitated and troubled as she is at this very time by the popular requirement of certain political rights. And whence comes this new war-cry? From those very same working classes who have, both on land and sea, contributed so much to the production of her wealth. In a free state, the feeling of the dignity of man grows simultaneously with the development of manufactures and navigation.

CHAPTER VII.

"LLOYD'S"—WHAT DOES THIS NAME MEAN?—THE MERCHANTS OF THE CITY OF LONDON—THE MEETING-PLACE OF MARITIME INSURERS—THE "BLACK BOOK"—HOW IT HAPPENS THAT LLOYD'S IS THE GREAT CENTRE OF MARITIME NEWS—LLOYD'S LIST—ICEBERGS AND OTHER DANGERS OF THE SEA—DIFFERENCE BETWEEN LLOYD'S AND A MARITIME INSURANCE COMPANY—DISTINCTIVE CHARACTERISTICS OF THE INSTITUTION—THE UNDERWRITERS' ROOM—THE INSURANCE BROKER—CONDITIONS AFFECTING THE MARITIME INSURANCE MARKET—STATE OF THE WEATHER CONSULTED BY SPECULATIVE INSURERS—HAZARDOUS INSURANCES—RICHARD THORNTON—REGULARITY WITH WHICH THE MEMBERS OF LLOYD'S FULFIL THEIR ENGAGEMENTS—MARINE CHARTS—SYSTEM OF SUBSCRIPTIONS.

It is surely a cause for surprise that the old English poets, sons though they be of a maritime nation, have seemed so little to comprehend the true beauties of the ocean. Shakspeare himself speaks of it more as an enemy, or as a means of national defence; but generally he has little else in view than the inconstancy of the phenomena troubling the surface of the waves, and when he wishes to paint the temperament of Hamlet, he makes use of the well-known comparison:—"Mad as the sea and wind, when both contend which is the mightier." No fixed laws had then been discovered to account for facts which those of the old time looked

upon as nothing more than the obscure caprices of nature. It is science, after all, which, during the last century or less, has brought to light the real poetry of the sea. Ship-captains, by sounding the depths of the watery abyss, and meteorologists, by studying charts of the winds and investigating the causes of storms, have done much to dissipate all foolish and superstitious terrors. As soon as this mass of troubled waters became less feared, it was more admired. Byron, who was born at a time when the boldness of men had increased as they came to understand better the laws which regulate the universe, appears struck much less with the wild madness of the waves than with the grand harmonies of the ocean. He has been one of the first to celebrate the triumphs of intellect over this wild and fickle element. But what would he have said if he had seen one of the iron frigates of our days crossing the Channel? It does not look as if the ship feared the sea; one would be inclined rather to say that the sea feared the ship; for the billows recoil in front of her bows with a sort of respect. Skilful navigators, therefore, not only contribute to the growth of commerce and the prosperity of nations, but they also increase the confidence of man and his means of operation in the never-ending conflict with the powers of nature.

In England various institutions are more or less connected with naval and nautical matters, and these must be separately studied if one wishes to form a just idea

of the whole of the system.* Just now, my task is first to call attention to the great centre of maritime assurance, then to some of the efforts which have been made to ameliorate the condition of the sailor during his stay on land, and also to some recent experiments made with a view of diffusing instruction among a class of men who were once no less boastful of their ignorance than justly proud of their bravery.

In the heart of the City of London stands a stone edifice, having a portico on its west front, with Corinthian pillars, and a pediment adorned with statues. At the other end it is provided with a tower, which is occasionally enlivened by a joyous peal of bells. This structure is both wanting in originality, and also devoid of any character of nationality; it might as well have stood at Hamburg, Berlin, or Moscow. Nevertheless, it is the *Bourse*, or Royal Exchange, of London. It was founded in 1565 by Sir Thomas Gresham, who conceived the idea of originating it during his stay at Antwerp. The first edifice was destroyed by fire, and another was built by Sir Christopher Wren in 1667. This latter Exchange was also burnt down in 1838. Mr. W. Tite was the architect of the present structure, the first stone of which was laid in 1842 by Prince Albert in great state. Many features in this Exchange

* See some remarks of mine on these subjects in the *Revue des Deux Mondes* of the 15th October, and the 1st December, 1866, which are embodied in the present work.

distinguish it from our *Bourse*. In the first place, public stocks and shares are not dealt in here; and the merchants and brokers, instead of meeting in a covered hall, stand in a court open to the air, not unlike the *cortili* in Italian palaces. Arcades, divided by columns from the centre court, and with the wall-panels and ceiling ornamented with painting in *fresco*, form a species of cloister all round, in which people may walk or take refuge in case of bad weather. The English never lose sight of utility, even in their works of art. There has been much laughter at the statue of the Duke of York, which, standing on the summit of a column near St. James's Park, carries a lightning-conductor on his head. The Royal Exchange of London, though it makes many just pretensions to architectural grandeur, has not any the more disdained the question of material and pecuniary interests. Almost the whole of the exterior of the building is occupied on the ground-floor by a row of shops, divided from one another by columns with Corinthian capitals. A great portion of the first-floor is filled with the offices of various Life and Fire Assurance Companies—some of them also insuring against the dangers of the sea; but among all these institutions the most celebrated in the whole world is, without question, *Lloyd's*.

And yet what is *Lloyd's?* Many of the English themselves would be perhaps somewhat embarrassed to answer this question. The secretary of this maritime

association* told me that he received many business-letters addressed to "Mr. Lloyd." Now this Mr. Lloyd is a myth, and none of the principal members of the institution bear any such name. But still, *myth* is hardly the word; I ought rather to have said *souvenir*. There was once, in fact, a Lloyd who kept a coffee-house in Lombard Street, and where the London merchants met who were interested in maritime insurance. When did he die? Nothing is known as to this; and as to the details of his life there is the same ignorance. A poem, however, exists, called *The Wealthy Shopkeeper, or Charitable Christian*, in which allusion is made to this man's establishment. The unknown author of this poem, published in 1700, a copy of which is carefully preserved in the Guildhall Library, speaks of the way in which a London merchant at that time employed his day; and adds, that he never missed "resorting to Lloyd's to read his letters and attend sales." From this passage, and some other documents, we may conclude that Lloyd's coffee-house was a central meeting-place for business-men, and also a focus of news—especially maritime news. Richard Steele speaks of this house in his "Journal;"† and Addison, in the

* One fact will at once give some idea of the way in which this combination of merchants is managed. The secretary told me that he did not even know by sight a great many of the members who every year do a large business in the establishment; so much does each act with perfect independence.

† See No. 246 of the *Tattler*, published in 1710.

"Spectator," likewise selected Lloyd's Coffee-house as the theatre of action in which to place a scene of commercial life in the eighteenth century. In the course of time, this locality did not at all correspond with the increasing development of business; the merchants betook themselves elsewhere, and, after having for a time gone from place to place in the City, ended by introducing their place of resort into the building of the Royal Exchange. The veritable, personal Lloyd, as we see, has made a great deal more noise in the world after his death than he ever did during his lifetime. No doubt he died under the impression that he had merely founded an obscure coffee-house, instead of which his name is now, by chance, as it were, connected inseparably with one of the greatest maritime institutions of England.

The Royal Exchange in London possesses two *façades*, the principal one, as before described, facing the west, and the other, a more modest one, which, looking towards the east, the opposite point of the horizon, bears the name of the *East Front*. If we penetrate into the interior on this latter side, we find ourselves immediately in a small court, which has been opened out by the architect to give air and light to this, the most massive, portion of the edifice. On the right in this court we see the entrance to the offices of Lloyd's. Pushing open the swinging mahogany glazed doors, we are in front of a stone staircase, the construction of which calls forth the admi-

ration of some, but the height of which is not blessed by the insurance brokers and their clerks. I was then introduced by the secretary into all the mysteries of this temple dedicated to navigation and commerce.

The entrance-doors upstairs are guarded, as it were, by two marble statues, the best of which is without question that of William Huskisson, a statesman who has left behind him in the City the most honourable reminiscences. But what does this tablet mean, likewise made of white marble, which is embedded in the wall and covered with a long inscription, bearing the date of 1841? It is what the English call a memorial, erected by a public subscription in honour of the *Times*. This journal had, in its columns, called attention to a coalition of adventurers who bid fair to ruin some of the banking-houses by means of false letters of credit, and thus to greatly injure the truest interests of commerce. This courageous action cost them a lawsuit on the part of those whose intrigues and fraudulent manœuvres they had sought to denounce. As the English law did not then admit a proof of the facts alleged as a defence in matters of libel, the *Times* was condemned to pay *one shilling* damages, and the costs of the suit. Lloyd's proposed to reimburse them for these legal expenses, and raised for this purpose among their members a sum of £2,700. As the *Times* utterly refused to accept this money, the amount of 150 guineas was devoted to perpetuating the remembrance of conduct so noble and disinterested.

The considerable balance remaining was employed in founding a scholarship for some deserving pupil at the City of London School—a result worthy both of the merchant-subscribers and of the Press, in this case scarcely to be called free. Leaving these memorials of political and social gratitude, we pass through a narrow enclosure scarcely divided off by a wooden barrier, in the middle of which sits in state in his box a kind of beadle in a red robe laced with gold, and we are now in a vestibule whither a large number of merchants daily resort to pick up any seafaring news.

The feature in trade which seems most despised by some writers is the tranquil and confined sort of life it induces; but in this how much they are mistaken! How much better has Shakspeare, the son of a nation of merchants, comprehended the character of those who have habituated themselves to great mercantile speculations! With what truth does he depict in *The Merchant of Venice* the anxieties of the man "whose mind is tossing on the ocean;" who, in his restless inquietude,—

> "should be still
> "Plucking the grass, to know where sits the wind."

There is no Sabbath rest for him; for, as he says:—

> "Should I go to church,
> And see the holy edifice of stone,
> And not bethink me straight of dangerous rocks;
> Which, touching but my gentle vessel's side,
> Would scatter all her spices on the stream,
> Enrobe the roaring waters with my silk!"

And yet commerce was in its infancy in Shakspeare's time. The anxieties of the merchant extend with his business until they cover the world. The English merchant especially, having so many bonds of union with the ocean, can hardly expect to always have tranquil sleep. Let the south-west squalls be ever so little let loose, the ruin of his house and family is hoarsely muttered through his dreams. Oh, if he could only see from afar the good ship in which he has risked the better part of his fortune! In the morning, he rushes to Lloyd's, the fountain-head of all marine news. Nothing either in his face or conduct shows the least emotion,—he has the art of veiling his features with a mask of indifference; but what a tempest of anxiety rages under this outward calm! He asks himself a thousand questions: What does the telegraph say? What ships have touched at distant ports? What are the names of those which have reached England? To all these questions, and many more, he finds answers affixed to the walls of the vestibule. There the lists and advices give exactly the maritime bulletin of the day. But the critical moment has yet to come: this man, whose whole fortune perhaps is on the sea, has not at present consulted the *Loss Book*, or, as it is also called, the *Black Book*.

This gloom-inspiring volume is placed by itself on a high desk, and each can refer to it in turn. It is of course written by hand, and contains every day the

accounts of the latest shipwrecks and marine disasters of which news have been received. The number of leaves covered with this mournful information varies much according to the season of the year. In summer, and in fine weather, one or two pages are quite sufficient for the brief recital of the sometimes tragical occurrences which have happened at sea; but in winter, and after heavy gales of wind, there are sometimes as many as twelve pages blackened with the sad summary of the losses announced by telegraph during the night. The style of these despatches is remarkable for a brevity more terrible, perhaps, than would be the highest flights of human eloquence: the name of the vessel lost, the place of its destination, the nature of its cargo, the coast on which it was shipwrecked,—this is all. It is the laconism of the deep: it is as if one saw the billows open and close again on the doomed ship. In each of these announcements—frigid and taciturn as fate itself—the mind may conjure up many a sad drama. How many human lives are there sacrificed? This is often the fact of which the *Black Book* takes but little notice; the matter with which it has exclusively to deal is the property insured against the perfidy of the sea. Who was the insurer, and who has lost? These are the great questions. It is also remarkable, after a storm, to see with what anxious and fidgety hands some of the insurance speculators turn over the pages of this sibylline book.

The question may naturally be asked, why they should get maritime news at Lloyd's before every one else. To explain this, it must be understood that this association has its agents in every part of the world and in every port of the ocean. These agents are sometimes rich merchants, sometimes consuls, but in every case, men who are enabled by their position to obtain a knowledge of every event that happens in navigable waters near them; they telegraph immediately the result of their inquiries. When I landed, about three years back, upon one of the group of rocks lost in the bosom of the waves which are called the Scilly Isles, there was only one thing which brought London to my mind, and that was the name "Lloyd's" in letters of brass on the door of one of the least poor-looking houses. I might have gone much further afield, into some of the still wilder islands of the Old or New World, and there, even at the very ends of the earth, —provided only that there was a town or port of some sort,—I should have found an agent of this English society. The definition of Lloyd's which was given by a City merchant can now be better understood by us:— "It is," said he, "a spider planted in the centre of a web which covers the whole sea, and the shipwrecked vessels are the dead flies."

The English newspapers are generally furnished by this establishment with all the news touching navigation. Besides this, it publishes a daily paper of its own,

known under the name of *Lloyd's List*. This maritime gazette is a very ancient one, for a number is in existence dated the 7th of June, 1745, at a time when Lloyd's was nothing but a coffee-house, where merchants habitually met. But this journal must have been in existence even earlier than the above date, as the number in question is the 996th, and, as *Lloyd's List* appeared at that time only once a week, there is every reason to believe it was even then eighteen years old. To any one who is unconnected with maritime affairs, *Lloyd's List* affords, of course, but little interest; it is, as its title imports, merely a list of the ships which have arrived at every port in the world; but it is a very different thing to those whose fortunes are floating about at the mercy of the waves. Short notices of events occurring at sea, conveyed in two or three lines, will often avail to warn the speculator to be on his guard. Some vessel, for instance, announces that she has met with icebergs within sight of Cape Horn. These white phantoms, so menacing to ships at sea, will hardly fail to haunt for a time the mind of the anxious merchant. This kind of intelligence exercises, besides, an influence on the market when cargoes which must traverse the same seas have to be insured in London. Thanks to these messages, the English can say that events at sea, as it were, "cast their shadows before them."

Maritime insurance constitutes the chief object of

this institution. The custom of a mutual guarantee against the perils of the winds and waves, by means of combinations more or less skilful, goes back, doubtless, to a very ancient epoch. No sooner had navigation extended its conquests than men, interested in the sundry enterprises of the mercantile marine, began to see the necessity of a mutual division among them of the risks and the losses; in short, of forming a defensive alliance against the fury of the ocean. There are no very certain *data* as to the origin of marine insurance in England, but it is known for certain that transactions of this kind were carried on in the old Lloyd's Coffee-house. This sort of business, as it developed, threw out accessory branches, and, when the City merchants left their original place of resort, it assumed a more decided character as a system of protection against the dangers which face both ships and merchandise intrusted to the inconstant waves. Nevertheless, it must be well remarked, Lloyd's is in no way, as it is too often called, a Marine Insurance *Company*.

If Lloyd's is not a *company*, then, what is it? It is a fraternity of merchants, shipowners, bankers, and other capitalists, combined together in the same place for the purpose of promoting the development of navigation and commerce, but more especially for protecting property at sea against the perfidy of the elements. The English draw a great distinction between a *company* and an *association:* the former restrains the

independence of its members, whilst the other leaves to each the liberty of acting as he thinks best; and this latter system is the one which is often preferred. The characteristic feature in marine insurance companies is, in fact, a system of unity of action. Having generally been established by a body of shareholders who divide the profits among them, they represent a community of interests confided to the hands of a managing director or responsible agent. Nothing of this sort is the case at Lloyd's; here the men assembled in the same room are in no way mutually connected by the *solidarité* of the same interests; each, on the contrary, acts on his own independent account, and at his own risk and peril. Each of them is guided only by his own intelligence, needs consult himself only, and must measure the extent of business which he undertakes by the standard of his own personal capital.

Lloyd's is thus based on the principle to which our neighbours attribute much of the greatness and prosperity of their commerce—individuality in union. On no account would the City merchant wish for any system of protection which would tend to sacrifice his independence of initiative action. Though, in case of need, he may look to the assistance of others, his own personal resources are the stay he always reckons on. At all events, if we wish to judge of this system in all its features—a system which, without any privileges or state guarantee, has raised the mechanism of marine

assurance to so high a pitch among our neighbours, all we have to do is to enter the large hall facing the vestibule, known under the name of the *underwriters' room.**

What an animated, yet demure, hubbub is here! One might fancy that the sea, with the thoughts of which every brain is occupied here, had imparted some of its agitation and uproar to the business world. The current of news, transactions taking place, and chat going on, runs from one end of the hall to the other with a kind of deep, murmuring roar. This hall is large and handsomely constructed; the ceiling, richly decorated, rests on two rows of scagliola columns. At intervals Lloyd's coat of arms—a golden anchor on a blue ground—emblazoned on escutcheons, stands out in relief a little distance from the cornice. Mahogany tables, placed pretty close to one another in succession all round the room, and surrounded by seats, serve as office desks to accommodate the underwriters and their clerks.

The persons who are constantly going to and fro in this hall are composed of two very distinct elements,—the insurers of ships and the insurance brokers. In principle, every one can go to Lloyd's and treat personally and directly with the underwriters, but, as a

* Strictly, word for word, an *underwriter* is a man who signs his name *under* what he writes, but the term is applied exclusively to the case of maritime insurers.

matter of fact, it is not very often that business is thus managed. If a merchant, for instance, wishes to insure a certain quality of merchandise that he is going to send to sea, the first man he may meet with in the room may not be prepared to undertake this particular branch of business. To whom, then, can he apply in the midst of the thick busy crowd, tossed here and there by the agitating wave of traffic? During the time he is seeking for some one to insure his goods, they may have been laden on board the ship on the point of sailing, and perhaps even have gone to the bottom of the sea. The merchant, therefore, finds it much more to his advantage to make application to a broker, who, knowing well all the habits of the place, can save him much useless trouble in consideration of a small commission. The broker, as a connecting link between the insurer and the insured, is really then, from the nature of his duties, the man who gives life and activity to the market. He is everywhere at once, transacting business with every one, and, like the sea-bird whose cries seem to stir up the waves, his excitement excites others.*

* I should, of course, have been glad to know the sum of money to which the insurances *underwritten* at Lloyd's amounted to every year; but this is a matter about which it is impossible to obtain any exact information. As the transactions are all private and personal, none of them appear in any of the books of the establishment. The secretary, however, informed me that millions every year circulate in these sorts of contracts, which are constantly being renewed; and when the English speak of millions, they mean pounds sterling.

But the life of an underwriter is not always *couleur de rose.* It is true he may be rich, and in most instances he is getting richer every day; but how often do the dark clouds gather up over the horizon of his dreams and his enterprises! We must not forget that he is carrying on a match against a terrible gambler—the ocean. He cannot hope to sway the chances except by means of prudence and calculation; nothing, therefore, is neglected so as to elevate the estimation of contingencies to the pitch of a science. The age of a ship and the way in which she is built, the description of cargo with which she is laden, the part of the world to which she is bound, the experience and character of the captain who commands her,—these are some elements of the foresight which is never neglected by a skilful underwriter in his estimation for a marine insurance.

The state of the weather must also be consulted. The *habitués* of Lloyd's have therefore two wonderful instruments ready for their reference,—a barometer and an anemometer,—both of which themselves note down the results shown. The anemometer especially, made by Osler, is endowed with automatic movements, and marks with a pencil on paper the force and direction of the wind at all times both of the day and night. In stormy weather this invisible hand, tracing mysterious characters on the wall of the underwriters' room, carries back the mind to the events of Belshazzar's feast, for this wind-inspired mechanism also often writes down in its

way the dark decrees of destiny, whence spring ruin and disaster in the world of commerce. Be this as it may, men whose fortunes turn upon the wind cannot afford to despise the notifications given even by a weather-cock; they are, as they say, so many signs from which they are able to draw conclusions.

But why is not meteorology a more advanced science? If it were so, there are many other questions the underwriters would be glad to demand of it; even in the present state of meteorological knowledge they seek to trace out, by means of rules and calculations more or less certain, the course taken by hurricanes in distant seas. The great art would be to be able to divine, from the atmospheric indications in London, what the state of the weather might be in the latitudes where any insured ships are sailing. Although the underwriters are, in this respect at least, the philosophers of our time, I do not think that the reach of their science extends thus far as yet; but I should not be surprised if the interested efforts of speculation should one day or other draw out from nature some fresh secret, by bringing to bear on this mysterious order of facts the study of the laws of the atmosphere and the observations of meteorologists.

Maritime insurances may be divided into two classes. The first, regular and methodical, founded on the calculation of probabilities, is that which is in use in ordinary cases; the other, on the contrary, being more

or less dependent on chance, needs the concurrence of certain mysterious circumstances to give rise to and develop it. It happens, for instance, that within the desired and usual time a ship has not reached the port to which it was bound; other ships, of which intelligence has been received, have sailed over the same tract of ocean, and have not "spoken" the lost one. What has become of it? There is certainly ample room for anxiety, and yet, on the other hand, there is nothing to prove absolutely that the ship is lost. It readily occurs that a vessel, the fate of which appears so fearfully uncertain, opens up a free career to fresh insurance transactions. Men are almost always to be found who are venturesome enough to risk considerable sums on such ships, having in view the large profits they would make if the vessel hitherto lost sight of should by any chance turn up. Under conditions such as these, insurance becomes a lottery; the money is staked on a shadow, on the name of a thing which at the very time may be perhaps a prey to the ocean. Some years back a steamship was the especial cause of a large quantity of this doubtful style of business: this was the *President*, about the fate of which for several weeks hovered a silence of ill-omen. Up to the last moment, that is, until all hope had been relinquished, this vessel, at Lloyd's, still continued to float on with all sails set on the ocean of speculation, and amid the turmoils of finance. In consideration of a very high

premium, risks on the vessel about which, unfortunately, there was no longer any risk at all, were largely insured in the underwriters' room. Facts of the same sort occur again and again every day, and large sums of money are constantly being swallowed up in this maritime game of chance.

We must not, however, confound the evil with the good, and judge of the whole tree by one faulty branch. This system of marine insurance renders both to commerce and navigation services which are recognised all over the world. What private, individual fortune is capable of fighting single-handed against the peril of tempests? If the spirit of adventure and commercial enterprise had been abandoned to its own personal resources alone, it would have doubtless long since relinquished a field of operation sown with such a harvest of ruin. Leaning for support on the union of action, and on the division of risks, it can, on the contrary, brave the most destructive of elements and dispute the victory with fortune. Thus every vessel and every cargo intrusted to the bosom of the waves is, or ought to be, insured beforehand—sometimes for a small sum, sometimes, on the other hand, for an extremely large one—according to the value of the ship and the commodities it carries. Like all other places to which capitalists resort, Lloyd's has its celebrities. Amongst the men who have lately drawn most attention by the boldness and extent of their contracts in respect to

maritime insurance, the chief was Richard Thornton, a City merchant, who died a year or two ago, leaving behind him a fortune of £3,700,000.

Richard Thornton was born in 1776, and commenced his commercial career during the wars of the first empire, when Great Britain found herself shut out from all the markets of Europe. In conjunction with a partner (his brother), he made up his mind to fight against the continental blockade by means of courage and stratagem. The port of Dantzic was at that time closed against English ships by a division of the French army under General Rapp, and all the other seaports of North Germany were in the same way strictly guarded. All these belligerent arrangements in no way intimidated our two merchant shipowners of the City of London. They protested that they would make their way with their commodities through all the meshes of this iron net-work.

Richard Thornton was one day on board one of his vessels in the Baltic when they met a Danish man-of-war which hailed them to surrender. The English merchant-ship was armed with several guns, and replied to the hostile summons by a vigorous cannonade, which soon put to flight the warlike agent of French policy.

In 1810 the English Admiralty were in want of hemp for the sails and rigging of the fleet. St. Petersburg was the only place where they could procure this

raw material in any considerable quantity; but at that time all the English merchants had escaped, or had been driven away, from the capital of the Russian empire. Thornton, at his own personal expense and risk, undertook this dangerous piece of business. He landed privately at Memel, and, in spite of every obstacle, he succeeded in shipping several millions of bales of hemp, and bringing them safely by sea to his country, to replume the wings of the sea-birds of the British fleet. It may be well imagined that he was magnificently recompensed for such services as these. But certain signs appeared in the political horizon, the harbingers of the decline of the empire founded by Napoleon. These presages were watched with an observant eye by the merchant in the depths of the City. In 1812 he was the first in London to get tidings of the overthrow of Moscow. The news came to him from his brother, who was then in Russia, three days before the English ministers, and the mercantile world generally, were informed of the event. He profited by this early intelligence to the amount of £200,000. When the seas were again opened to trade in 1815, Richard Thornton sought out fresh fields in which to push his fortunes. About 1830 his views became directed towards the Peninsula. Judging that the system carried on in Portugal by Dom Miguel was a mad one, and that the Carlist enterprises would not succeed in Spain, he thought it would be a good stroke of business to

underwrite the fall of these two ancient dynasties. He therefore advanced considerable sums to form an accumulation of munitions of war in the Azores, and when Dom Pedro's army began its campaign, he took upon himself to pay, equip, and feed the soldiers. It is well known how favourably this war terminated in 1834 for Richard Thornton and for the daughter of Dom Pedro. The affairs of Portugal were scarcely settled ere he had to defend with his gold another young Infanta against another usurper. It is stated that Thornton was at that time the creditor of Spain for the sum of *two millions of pounds sterling.*

This merchant queen-maker had been a member of the Underwriters' Association at Lloyd's since the year 1798. He was looked upon by every one there as the *lion* of the place; and just as that noble animal, relying in his strength, disdains the precautions with which his rivals protect themselves, he had a royal way of doing business which was all his own. Whilst other insurers generally divide among themselves the responsibility of a risk, so that, in case of misfortune, the loss of a ship or cargo would fall, not on one only, but on twenty or thirty individuals jointly interested, Richard Thornton, on the contrary, alone in his power, accepted, with a bold front, chances which might make a royal fortune tremble. The secretary of Lloyd's told me that he had one day seen him undertake, in a single line of writing, a risk of £200,000, and this with the

utmost nonchalance. Before the last war between his country and Russia, he insured on his sole account and risk the whole value of a steamship built in an English dockyard for the Muscovite Government. One day, when a friend expressed to him his fears of the boldness of a bargain of this sort, concluded with a foreign Government: "Oh!" replied Thornton; "if they lose the man-of-war I have insured for them, I have plenty of their own bills in my safe to pay them with."

Although this City merchant was certainly an exception to general rules, still we may judge by his case how immense is the fortune of some English merchants, and what an influence they exercise in the world. Now there are but few of these rich nabobs of commerce who are not more or less closely connected with Lloyd's. It is easy enough to guess what advantage the association derives from such an assemblage of men of capital and commercial renown. The regularity with which the underwriters honour their engagements is proverbial. As soon as the actual proof of a shipwreck or a loss is furnished to the insurers, the accounts are at once adjusted, and, one month afterwards, the person claiming on the policy receives his money. Their word, as is said, is as good as a bank-note. Confidence and security being the moving spirit of this sort of business, it is not difficult to understand why Lloyd's has become the centre of maritime insurance. Large and flourishing companies, supported by numerous share-

holders, have branched out from this parent trunk, the ramifications of which spread over all the enterprises of navigation, protecting English commerce against the bankruptcies of the ocean.

Besides the underwriters' room, this establishment comprises several other very interesting details. A room lined with wainscoting is surrounded by a hanging gallery, which is reached by a staircase; the panels in this gallery are covered with maritime charts fixed on movable rollers, and arranged with wonderful care. On one side, in a lower room, is a collection of books of maps, many of which are presents to the association from the various European governments. One of these large volumes, magnificently bound, was a gift from King Louis Philippe: it was shown to me especially, as a *souvenir* of my country.

The reading-room is eighty feet long, and occupies a portion of the north side of the Exchange. Here may be seen files of newspapers, maritime gazettes, and commercial circulars, arranged according to nations and countries. Here is India, China, Australia, Canada. The two large round tables may be said, in fact, to represent the two worlds, with their political divisions. Thanks to this arrangement, the reader can embrace at one glance the state of commerce in every part of the earth. The innumerable threads of the vast network of business which spreads alike over continents and oceans are thus, as it were, brought together to

one point for the use and profit of the *habitués* of Lloyd's.

The expenses of this institution amount to more than £10,000 a year, and as no deduction is made from the profits of its members, the question naturally suggests itself—How is the association maintained? To answer this question it will suffice to point out the principal source of its revenue. Lloyd's is chiefly dependent on subscriptions, and each member contributes, according to certain rules, to maintain the prosperity of the establishment. The members are divided into three classes: first, the *underwriting members;* secondly, the *non-underwriting members;* and lastly, the *annual subscribers.* Underwriters, on joining the association, pay down an entrance fee of £50, and an annual subscription of twelve guineas is afterwards required of them, and five guineas annually for any substitute or clerk who takes their place in the establishment. The non-underwriting members, that is, the *brokers,* pay £25 at their entrance, and an annual subscription of four guineas for themselves, and the same for every clerk they employ there. Annual subscribers are received on contributing a quota of five guineas each.

The underwriting members, who bear the largest share of the expenses, are also those whose character and responsibility require the highest guarantees. Thus, in order to be accepted as an underwriting member, a recommendation is necessary, signed by six

associates of the fraternity. We shall at once understand the necessity of a control of this sort if we reflect that Lloyd's—this domicile of an imaginary being, this commercial myth—owes its reputation and its success entirely to the integrity of the men who represent it in flesh and blood. It is the severity ruling in the choice of its associates which so much induces the confidence of the public. We must remember that the underwriters, either as a body or individually, give no kind of "material guarantee," and that each deals with his special resources at his own proper cost and risk, or at the risk of the maritime insurance company to which he belongs, and that, consequently, the various parts of the system are connected together by a merely *moral* bond of union.

The business of the association is conducted by a committee of twelve members, one of whom performs the duties of chairman. The committee generally choose as their chief some great London merchant having a seat in Parliament, and occupying an eminent position in the world. The working staff of the establishment is composed of the secretary, an admiral in the navy; assistants, clerks, messengers, and a certain class of *employés* who are called *waiters*, in recollection, there is reason to believe, of the time when Lloyd's was still a coffee-house only. Owing to the subscriptions and some other branches of income, this association of maritime insurers is extremely rich.

A portion of the surplus funds is employed in relieving some of the suffering caused by disasters at sea, in helping to defend British sailors against the insults and injuries of barbarous nations, and in rewarding those who distinguish themselves in saving life from shipwreck.

In conclusion, Lloyd's is an establishment which is, throughout the world, without a parallel, and represents, in fact, all that can be done by the resources of a great commercial people to furnish encouragement to, and promote the security of, a system of mercantile navigation, on which they so much depend. And yet all the influence that money could give would be as nothing without the concurrent aid of the brave British sailor. Should we not, therefore, now turn our attention more particularly to this class? We will, in the first place, consider the sailor on shore. What is the kind of life which he leads in London and other great seaport towns when he has, for a time, left his almost native element, either until his ship again puts to sea, or, employed on board some other vessel, he is again cast upon the ocean, his truest home?

CHAPTER VIII.

THE SAILOR IN THE PORT OF LONDON—CRIMPS—WHERE DO SAILORS LODGE?—CHARACTERISTICS OF THE WAPPING LODGING-HOUSES—THE LAND-SHARK—HOW HE DEVOURS SAILORS—HONESTY OF ENGLISH SAILORS — HOW THEY MAY BE DECEIVED — THEIR CHIVALROUS CHARACTER—THEIR RESPECT FOR WOMAN—HOW JACK'S GOOD QUALITIES AND FAULTS ARE TAKEN ADVANTAGE OF—A BLACK SHARK—THE BRUNSWICK THEATRE—CAPTAINS GAMBIER, ELLIOT, AND JUSTICE—THE SAILORS' HOME—ITS POST-OFFICE—ITS BANK—THE SAILORS' DINNER—THE REFECTORY—THE CABINS OR SLEEPING-ROOMS—FINANCIAL ORGANISATION OF THE SAILORS' HOME—OBSTACLES OPPOSING THE DEVELOPMENT OF THESE INSTITUTIONS—SERVICES WHICH THEY HAVE RENDERED—WHAT REMAINS TO BE DONE—SAILORS' ASYLUM.

When a vessel returns from a long voyage, and is ascending the river Thames, as soon as she gets as high up as Gravesend she is beset with all kinds of proffered services. Men of rather suspicious appearance, but endeavouring to conceal their designs under an air of frankness and free-and-easy cordiality, generally come on board the ships, and in a thousand ways tempt the sailors of the crew to come and lodge at their houses. This clamorous pack, so eager for their prey, is composed partly of the lodging-house keepers themselves, well known in nautical jargon under the

name of *crimps,* and partly of their emissaries, who in the same slang are called *touters,* and receive a commission of so much *per cent.* for all the sailors they can bring to the low lodging-houses kept by their principals.* Poor unsuspecting *Jack* (the nickname of the sailor, be it recollected) hardly knows who to listen to in the midst of the tumult of importunity, and it must, besides, be confessed that his natural artlessness leaves him exposed to fall into every kind of snare. Fancy yourself for a moment placed in his position. Many of the crew are, perhaps, coming to the port of London for the first time, and when they get there they neither meet with any friendly voice to bid them welcome, nor any trustworthy guide to direct their steps. But I am in error here; they find plenty of friends, as far, at least, as appearances go; but how is it possible for them to get at the real intent of those who surround them with their plausible proposals? We must not forget that a life on the ocean has for long past cut them off from any intercourse with the daily life of men on land.

On shore the mariner feels himself a stranger; the same man who but just now was strong to defend his

* The commissions paid by the *crimps* to these *touters* vary according to circumstances. In general the worst class of lodging-houses recompense their agents more liberally than the respectable ones. *They can afford it better.* The sailor is thus, on his arrival in port, *sold* and *bought,* without the least suspecting the existence of the iniquitous contract.

ship and passengers against the terrors of the tempest, is all too weak to repel a perfidious smile or the lies of a smooth-tongued cheat. Simple as he is, and without guile, how is it to be wondered at that he too often becomes the victim of deceit, and that these hardy sea-dogs are, when on land, shorn like sheep? It is very true that some may have already visited the port of London, and know by experience to what dangers they are exposed. These men often pour out their anger in a burst of rather strong language against these *land-sharks*, for this is the name the English sailor gives to these greedy lodging-keepers. In spite of having been often deceived, Jack is still credulous, and perhaps also a little too self-confident: it is not long since he was *taken in* before, and he can scarcely believe that they will be so soon again able to practise on his credulity. And after all, he does not care much about it. In case of need, he is always quite ready to risk his life. Why, then, should he haggle about his money? He knows quite well all the time that he is going to be "eaten up," as he says, "by the land-sharks," and yet he goes to them—having, perhaps, given them his word on a former voyage—and, with the utmost *sang-froid*, takes his way to the same dens, the snares of which he knows only too well.

The sailors' district in London is not a very extensive one. The houses intended for their accommodation are mostly concentrated in Wapping, Shadwell,

about Ratcliff Highway, and round the docks generally. The proprietors of these establishments pretty well understand the character of the English sailor, and know how to attack him on his weak side. When Jack is ashore, one class of objects always rejoices his heart, and these are the appurtenances of his profession. A shop whose glass front can boast of a model of a ship, complete with sails and rigging, will never want for sailor customers; it will certainly draw all the seamen in the district. Those who provide furnished lodgings for sailors, knowing how impressible he is by everything which reminds him of the sea, take care not to neglect this peculiarity in his habits, and seek in every way to make the most of it for their own interest. Hence we often see these houses surmounted with a fully-rigged mast. If a cannon is added it is all the better, but the highest point of art seems to be to paint on the outside walls the flags of the various maritime powers, with their emblems and their colours. Though Jack may be brimful of nationality, still he is a little cosmopolitan in his ideas, and his desire is that every part of the world should be done justice to.

Certainly, in spite of all the devices to flatter the *amour-propre* of the mariner, some of these wretched places, situated down dark alleys and courts, with their dirty, gloomy-looking windows, have more the appearance of thieves' dens than of places intended for comfort or pleasure. These, however, are the caravansaries in

which the English sailor takes his ease. If we pay a closer attention to them we shall not be long in discovering the kind of seductions which attract him into these places, where his purse, his health, and sometimes even his honour, are endangered. Very often strange sounds are heard to proceed from these traps for the unwary,—the scraping noise of a shrill-toned violin, or the hoarse voice of a female singer. Sometimes a sluttish-looking siren takes her stand upon the door-step, well justifying the proverb, "Salt water doesn't wash clean," fantastically clad in faded finery. Dancing, drinking, and tobacco are the three charms for the sailor in this smoky *Eldorado*, where his fate too often is to spend in one short week the earnings of a year. Generous as he is by nature, he often makes rather a bravado of his excessive liberality; and, if he scatters his money to the winds, it is just to show how rich he is, and that the sea is not a bad paymaster. The English sailor earns the respect of honest folk by his good qualities; but, amongst the people with whom he mostly associates, he becomes a favourite principally for his faults, the chief of which are carelessness and prodigality. Alas! it is not long before he pays dearly for the innocent pleasure of humbling with his largesse the "land-lubbers," * as he calls them, and proving to

* A term of contempt, which, in the mouth of the English sailor, answers pretty nearly to the word *pekin* as used by the French soldiers. The expression is a very old one, and recalls the time

them that it is on the sea that the golden fleece is to be sought for. At the expiration of a few days his seal-skin purse is emptied. This is the moment which is taken advantage of by the "land-sharks" to take possession of the mariner, body and soul.

The sailor who has plenty of money is certainly a profitable prize; but, when he is penniless, he is a different, though little less lucrative prey. Especially in the latter case the *crimp* tries his best to draw him into his snares. First of all, he advances to him various small sums, of which he keeps back as interest eighteen-pence in every pound. After a long voyage, of course Jack requires to renew his old clothes, worn and stained as they are with tar and sea-water. His friend "the shark" undertakes to "rig him out," and for this purpose enters into a league with some nautical clothes-dealer, well known under the name of a *slop-seller*. A complete fit-out of all that he needs is thus provided for him at about fifty per cent. above the market-price. But, after all, the most serious element in this ruinous sort of bargain is, that the sailor thereby pledges his liberty. In exchange for all his pretended services, the *crimp*, by a formal contract, purchases his future gains. From henceforth the poor wretch is actually eating and drinking at his master's table the price of his own slavery. After his brief intoxication of coarse

when the old "sea-dog" of Great Britain thought himself the ideal of creation.

pleasures, he cannot, in fact, fail soon to see that he is sold, body and soul. In some cases the lodging-house keeper will, perhaps, conspire with some captain having as little conscience as himself, and will enter the unlucky sailor for a long voyage at an abominably low rate of pay. He draws the money in then with both hands: with one he fingers the recompense from the master of the merchant-ship; with the other, the salary, paid in advance, of the man whose creditor he is. Plenty of stories, rather hackneyed, it is true, are told of sailors being carried off in a drunken sleep, and conveyed in the night on board vessels about to sail the next morning at daybreak. The fact is, that when a sailor has once fallen into the claws of the usurer, he is no longer his own property: under one form or another, he cannot help relinquishing much of his manly dignity in the snares to which he is exposed, and is only too happy when they do not take advantage of his innocence to expose him to the rigour of laws he has unwittingly broken.

It is very certain that the "tar"* (another nickname for the British sailor) carries his ideas of honour to a very high pitch. We may judge by one fact. Some years back a smart young sailor entered one of the

* The English are very fond of nicknaming certain callings from the objects with which those following them are brought in daily contact: hence from the words *tar* and *salt* proceed the well-known *sobriquets* for seamen.

shops in Glasgow, and, addressing the grave-looking man behind the counter, said, looking him straight in the face, "Do you recognise me?" "No," replied the shopkeeper, after having examined the features of the stranger. "Well," replied gaily the blue-coated youth, "I am the lad who, three years ago, being by chance in your shop, was sticking a postage-stamp on a letter, and by accident pushed my elbow through one of the window-panes in your shop-front and broke it. This is the very one," said he, pointing out a pane which had been replaced. "I then had no money—not a penny left in my pocket—for I had just spent my last in writing to my mother. However, I promised I would pay you on my return from my voyage. Since that time I have been in the Indies, and in China, but I have never forgotten my debt." Throwing down a sovereign on the counter, he received the change that was due to him, after the proper deduction had been made, and went away with a light heart.

Proofs of a delicacy of feeling of this kind on the part of the British sailor are by no means rare; and yet the very same man, who could not sleep in peace if he had the weight on his conscience of a single shilling belonging to any one else, would be ready enough, in certain cases, to play off an artful trick on some captain of a merchantman, against whom his prejudices may be only too easily excited. He pretty well understands the rules of general morality, but as to the code of

commercial obligations, and the laws of simple contract, they are a dark page to him in his book of precepts. Nothing, therefore, is easier than to mislead, on some points, his simple probity. It too often happens that the *crimp* persuades one of his victims to break the engagement which he has signed for some one of the vessels in port, and to enter himself clandestinely for another, from which he is deluded into expecting some illicit advantage. If, in a case like this, recourse is had to the courts of law, it is of course poor Jack who is prosecuted, and not the man who has given him the perfidious advice.

We shall better comprehend the kind of dangers to which the English sailor is exposed in the large seaport towns, if we get to understand some other features of his character. The feelings of chivalry which, since the termination of the heroic age, have been banished from the face of the earth, seem to have taken refuge in the wide waters. As the champion of the weaker sex, the *tar* will defend them with his fist instead of his lance on every occasion when he fancies that they are ill-treated. No woman in difficulty or danger has ever claimed his services in vain. He has been seen to take off his large blue jacket in the depth of winter to cover up a mother sitting in a railway-carriage surrounded by her children, and to warm their little red fingers, benumbed with cold, with his hands rough and hardened by the rigging. An Englishwoman who was

travelling in bad weather, with but little money and a numerous family, relates that she was, we may almost say, preserved by the kind attentions of a sailor, who took care of her and her little flock with a disinterestedness which would have done credit to one of the ancient knights-errant. And when she asked the name of her benefactor: "Bah!" said he. "When you hear the north wind roaring, and see the lightning flash, I am sure you will bear in mind that Jack is most likely at sea." Unfortunately, these generous instincts sometimes lead the English sailor into some curious mistakes. Here is an example of one.

A sailor, who had just been receiving his pay, and, of course, treating his friends, was passing down a street at night, when he was plundered by a female of his watch and purse. Having taken her in the fact, he handed over the thief to the police, who conducted her to the station-house. As they were going there, the cries and sobs of the woman so softened the heart of the sailor, that he warmly entreated the policeman to give the unfortunate creature her liberty. Deaf to these appeals, and even to an offer of money, the guardian of the public peace refused to betray his duty; but, touched with the emotion the sailor showed, he charitably informed him that, according to the English law, the prisoner would be discharged the next morning if no one appeared to prosecute her before the magistrate. This was, at all events, some little consolation;

but still Jack had the fact on his mind that he had been the means of causing pain to a woman. So he took to prowling about all night long round the police-station, looking wistfully at one of the barred windows, and listening with remorse to the sobs of the prisoner, whose confinement had been caused by an English sailor. At length daybreak appeared; and, in due course, the magistrate took his seat on the bench, and the persons who had been apprehended during the night were in turn brought before him. One female only remained to be examined, and, as no complainant came to give evidence against her, she was soon set at liberty. But Jack was waiting at the door with a paper in his hand: this paper was a marriage-license, which he had himself been to procure at Doctors' Commons—the place where these documents are supplied. They went without delay to the church, where the sailor naïvely told the minister his sudden and whimsical resolution. "He had," he said, "a kind of nightmare on his conscience, and he wished to marry this woman, because he had been a cause of grief to her." The clergyman endeavoured, in vain, to dissuade him from such a rash proceeding. They were married; and, next day, Jack went to sea for another voyage. It is easy enough to foresee the consequences of a union of this sort: about three years had elapsed since the performance of the ceremony, when the clerk of the church at which it had taken place received a visit from a pale and sorrowful

man, whom he soon recognised as the *quondam* adorer of the weeping fair one. The sailor had come to make the proposition of laying out twice the sum he had paid for the marriage-license, "if he could only be *unmarried.*"

We can easily understand what profits may be derived by those who are vile enough to speculate on the impulses of a character so prone to enthusiasm. The English sailor, when on shore, is surrounded by harpies, to whom his chivalrous imagination is too ready to attribute all the features of persecuted victims. He is certainly not deficient either in good sense or intelligence, but a knowledge of the practical dealings of life is wanting. His maritime charts have taught him nothing as to the rocks and shoals which lie in his course in the great seaport towns. Giant as he may be in a conflict with the elements, he is little better than a child in his knowledge how to manage amidst the intrigues of a deceitful community. These old sea-dragons (and it is a source of ridicule in respect to them) bite, just like fresh-water gudgeons, at the very rudest baits. And it is not only the British sailor whose good faith is thus taken advantage of in London; the seamen of other countries are, perhaps, still worse treated. There are *sharks* in Wapping and its vicinity of more than one colour; some of them are black, and make it their business to allure and then prey upon the sailors of the African race.

These facts had all been well known for a long time, and every English moralist deplored that such a state of things should exist, when, in 1827, three captains in the royal navy—Captains Gambier, Elliot, and Justice—resolved to try to put an end to such odious practices. At this time the Brunswick Theatre at Wapping had just fallen down, burying under its ruins a considerable number of persons. It was situated in the vicinity of the London Docks, and the locality appeared a favourable one to the originators of the schemes of reform. With their own personal resources, and those of some friends, they bought the ground and the old materials, with a view of building on the site a house intended to provide lodgings for sailors during their sojourn in the metropolis. Captain Elliot relinquished all the advantages which his birth, his education, and his position could offer him in the world, to shut himself up in a humble lodging in the middle of one of the lowest districts in London. There he personally superintended the erection of the edifice, and in 1835, when the establishment was opened, he devoted both his time and exertions to the labour of its management. The work prospered, and between 1854 and 1859, the directors of the institution bought another piece of ground, so as to increase the space at their disposal. A new wing was attached to the former building, the first stone of which was laid by Lord Palmerston in 1863, and the new edifice was inaugurated the 26th

May, 1865, by the Prince of Wales. Into this institution—the Sailors' Home—Captain Webb, the secretary of the society, was kind enough to introduce me, and showed and explained everything to me with a courtesy seldom to be met with.

There are two entrances, one in Wells Street, and the other in Dock Street; the latter is unquestionably the most ornamental one, and the stone *façade*, artistically carved out with the chisel, presents a striking contrast to the other houses of the district, which are of a mean character. The ground floor is occupied by a vestibule with large pillars, from which radiate long corridors with offices opening into them. Some of these offices—those, for instance, in which the sailors of different crews are engaged or dismissed—are under the superintendence of the Board of Trade; others are connected with the Admiralty, as, for instance, the Royal Naval Reserve Office, where the sailors of the merchant service are enrolled as volunteers in the reserved force of the royal navy. The Sailors' Home only lets to them a portion of its premises, but it is easy to perceive that this gathering together the various branches of the general maritime system must present considerable advantages to the inmates of the establishment. Some of the offices, indeed, are entirely devoted to their personal business.

There is, for instance, the Post Office, where letters are received, and, in case of need, taken care of for

a year, be they addressed to lodgers in the establishment or to men whom they may have reason to expect within a certain time. Whilst the *crimps* have every interest in isolating the English sailor as much as possible, and in detaching him from every family tie, the directors of the Sailors' Home, on the contrary, take every means that lie in their power to renew in him the severed link in the chain of moral affections. From 1865 to 1866, 15,000 letters have passed through the box of this establishment, many of which, no doubt, have brought back the memory of home joys to the hearts of sailors, tried as they are by the effects of long-timed absence.

The greater part of the sailors have their purses empty when they come on shore. Their wages-account with the captain of the merchant ship in which they have served during the voyage cannot be settled until some days after their arrival in port, and the *land-sharks* derive a special profit out of this temporary want of money, in order to make quick work in devouring them. The Sailors' Home, on the contrary, so far from deriving any advantage from a system of payment which is certainly to be regretted, advances a sovereign to each sailor who is in want of it, and allows him time to receive his wages, supplying to him as well a liberal and generous hospitality. Another proof of the kind care exercised is the desire shown to protect the sailor from being plundered of his money,

which is so hardly earned, and in most cases so carelessly spent. The institution receives on deposit any sums of money which the inmates wish to leave, and these payments, for which the bank of the Sailors' Home considers itself responsible, give rise to a rather considerable responsibility. The cashier also undertakes, whenever the boarders desire it, to recover any debts due to them, to transmit money to their families, and to transact any other business for them that requires the practical knowledge which they do not possess. The extent and usefulness of the services thus rendered may be easily judged of by the fact that since the foundation of the establishment the sum total of the deposits has amounted to the large sum of £1,358,704. Up to the 30th April, 1866, the money belonging to sailors that was received at the bank amounted to £94,811. Of this total, £36,691 had been sent to their families, £3,662 had been placed in the savings' bank, and the remainder, £54,458, had been drawn out by the men themselves.

The directors have also taken care to provide instruction for sailors. Annexed to the establishment is a school of navigation, in which are taught the first principles of geometry, algebra, and nautical astronomy. The building is also connected with a church, known by the name of the Seamen's Church, at which the sailors can attend every Sunday without even going out of doors, but the most complete liberty of con-

science is allowed to every one, and the religious services are frequented by the men of their own good will only. Few could fail to appreciate the end and aim of this institution, founded, as it is, both to increase the comfort and elevate the morality of the nautical part of the population.

The clock had just struck one in the afternoon, and the ringing of the bell announced dinner-time. A wide stone staircase leads to the first floor, where two tables are arranged in two different rooms: one is for the officers, and one for the "common sailors." It is to the latter that our attention must especially be directed. Some of them are clad with a certain degree of taste, especially as regards their neck-ties, fastened with a gold or silver ring (this is the great dandyism of the sailor); others, on the contrary, wear the rough blue jackets in which they have defied the tempest and the billows. There are some among them of all nations and all colours, for the Sailors' Home was set on foot for the whole world at large, and the dark-skinned natives of burning Africa are found side by side with the fair sons of Albion. Just at the time I visited this home-like brotherhood of sailors, there were but three hundred inmates. The secretary called my attention to the fact that this unfavourable circumstance was owing to the weather, and that the east wind, which had blown for more than a week, had prevented many vessels at sea

from entering the mouth of the Thames. Like everything else that has to do with nautical matters, the chances of the day even here must depend upon the caprice of the elements, but these alternations cannot affect the general results of the year, which are sufficiently gratifying. In the year 1865 to 1866 the establishment had entertained 11,388 seamen of all countries. The total number of boarders since the commencement (1835) amounted, up to the month of April, 1865, to 169,905, 49,286 of whom were *habitués*, as it were, who returned, time after time, after each voyage, whenever they visited the port of London.

The sailors' dining-room is large and ornamented with two monuments, one erected to the memory of Captain Elliot, the founder, and the other in honour of Captain Pierce, who was secretary of the institution for twenty-three years. Tables covered with white table-cloths, and abundantly furnished, were set at intervals down the room. I was invited to sit down and judge for myself as to the quality of the dishes. The substantial dinner supplied is certainly equal to that which you would have to pay five shillings for in some parts of London. It is curious to see how the great joints of roast meat, the dishes of potatoes, and the ponderous pies, disappear in the twinkling of an eye before the efforts of these vigorous appetites, sharpened by a life of toil in the fresh sea-breeze. A glass or two of good ale moistened this strengthening

and plentiful repast. As it was a Wednesday, some dishes of fish had been added to satisfy the scruples of Roman Catholic sailors. The requisite attendance was supplied by waiters, many of whom had themselves been old sailors, and their former calling might easily be perceived from their precision and cleanliness. Each boarder is at liberty to bring a friend to dine with him, but in this case he has to pay a shilling to defray the expense of his hospitality.

Not content with merely feeding the sailor well by supplying him with four meals a day—breakfast, dinner, tea, and supper—the institution has also sought to provide him with suitable lodging and bed. The most curious dormitory I have ever seen is the one which was opened in 1865, and bears the name of Admiral Sir Henry Hope, for many years president of the Sailors' Home. One might easily fancy it to be the interior of what the English would call a *four-decker*. The sleeping-rooms, 106 in number, are, in fact, cabins following one another in different floors. In these cabins are placed a bed, a chair, and a Bible. Light galleries, ascended by a staircase, lead to several ranges of doors, or, to make use of a nautical expression, tiers of decks. The sailor sleeping in one of these cabins might easily fancy that he was still on the wide ocean.

The directors, as we see, have spared no pains to make the sailors fond of the abode which they wish them to consider as their "home." Besides various

amusing games, they have the use of a library intrusted to the charge of the chaplain; they can also have the advantage of the daily visits of a medical man. The sailor is, of course, quite at liberty to come in and go out just as he pleases. It is true that at half-past eleven the street-door is closed; but the boarder who wishes to get in at a later hour of the night can obtain a pass from the superintendent. Amidst all this liberality of comfort, the most surprising thing is the cheapness of the charge for boarding.* It is true that the managers of the Sailors' Home, acting very differently from the *crimps*, do not seek to make any profit out of the sailor, and that, on the contrary, various generous people have expended considerable sums of money in founding this good work, the resources of which we will now allude to.

The Sailors' Home is grafted, so to speak, on a society the members of which pay a subscription of at least £1 a year. Those who give £10 at once are life-members. This is one of the branches of the income of the establishment; but still, we must not fail to state, it is by no means the principal one. The annual receipts, which vary from £7,000 to £9,000, are chiefly derived from the payments made by sailors for their board and lodging. If it were not for a debt of about £300, contracted for

* Officers of the merchant service pay 17*s.* a week, for which food, lodging, and washing are included; common sailors and boys pay 14*s.* a week.

a former purchase of ground, the institution would now be on the eve of self-support, and it is of great importance, as I think, that this should be so. It was necessary that generous hearts and hands should intervene to set on foot a work that would never have been originated without such help; but now that the Sailors' Home is once established, the managers would find it to their interest to separate it as soon as possible from a system of patronage which must always be more or less humiliating to the recipients. The sailor is by nature proud and independent; a considerable portion even of his errors, such as his carelessness and prodigality, proceed from his overweening confidence in his own strength and the resources of his profession. What does expense matter to him, and why should he take care for the morrow? The sea is always open to him, and when his pockets are empty, he can always enter himself again on board ship. When was there ever any want of rum and biscuit on the wide waters which give support to the leviathan? With a disposition of this sort, many sailors are repugnant to staying under a roof where they have a vague idea they are incurring an obligation to some one. The bread in which a grain of charity is mingled tastes bitter to them. I am very sure that the good reputation of the Sailors' Home will be much more strongly confirmed among seamen generally from the time when each man may be able to sit down, as at an hotel, at a table where he himself

pays the whole expense, and can sleep in a bed for the cost of which benevolence imposes no sacrifice to his dignity.

Even as matters now stand, these institutions are increasing in number. Twenty-four "homes," to which the one in Dock Street has served as the model, have been opened during the last few years in the principal seaport towns of the United Kingdom.

And yet, it must be confessed, their success has not at present come up to the just expectations which the originators had every right to entertain. It is very true that these institutions have to strive with many an obstacle. The *crimp* and his agents, whose interest so strongly lies in perpetuating the poverty of the sailor, of course try their best to dissuade him from entering an establishment which is solely intended for his good. "Don't go to the Sailors' Home," they say to him, even before he lands; "the cholera is raging there; the small-pox has just broken out, and is making frightful ravages; the yellow-fever was brought there last week by a crew come from New Orleans." Jack is brave, but artless. As he is not very apt to deceive any one, he does not understand how others can thus lie, and all these stories are not exactly of the nature that would attract him to the house in Dock Street. Besides the influence exercised by the *crimps*, the sailor finds several motives in his own personal feelings, which prevent him going to the Sailors' Home.

When men have been for months, sometimes perhaps for years, subject to the rough but stern discipline of a ship, their greatest desire, when they land, is to thoroughly enjoy their own freedom of action. The land is for them the land of liberty, which many of them, it is too true, associate with licentiousness; but, when all is said and done, Jack is neither saint nor monk; he does not come ashore to go into a monastery. The Sailors' Home, I readily admit, imposes a moral constraint only on its inmates; but it was of course necessary, for the sake of order and propriety, to have some rules laid down.* Now, if there is anything which is thoroughly detested by the sailor who has been so long under an iron bondage on board ship, it is the mere appearance of anything like *surveillance*. He thinks that, at last, he will be his own master, and spend his money just as he likes. "The sea-cormorant hates a cage," replied an old sailor to me, in answer to my representations how much better it would be for him to go into the Sailors' Home instead of being imposed upon in a low house in Wapping, where he was badly fed and worse lodged. Many other seamen concur in this opinion. What good is it to declaim against the dark dens into which the *land-shark* entices the sailor, and against the wretched rags with which the *slop-*

* It is forbidden to swear or to make use of coarse expressions; the sale of spirits is not allowed inside the house, and the sailor can only smoke his pipe in the large lower vestibule.

seller clothes him? These dens have, after all, a kind of charm for him, for he does what he likes there; and the rags are dear to him, for they are a sign of his independence.

God forbid that I should be supposed to be speaking against the Sailors' Home, and taking the part of those sailors who are opposed to their own interests. These institutions have rendered very great service, and may be made to render still more. Everything is well conducted in them; indeed, if I might venture to fully express my feelings, I should say that everything was *too* well conducted. So long as the directors of these institutions seek to make them schools of morality, they will preach only to the converted. The most right-minded among the sailors—those who have already contracted habits of order and sobriety—will unquestionably find in these houses a refuge against the fraud and temptations of a great city; but the great *residuum* of the maritime class will remain more or less alienated from the benefits of the Sailors' Home. Could not some middle line be taken? Between the homes of the crimps, who are the scourge of ships' crews when ashore, and institutions founded distinctively on religious principles, surely there is room for establishments where the main body of sailors generally might find themselves protected against a system of extortion without making any sacrifice whatever to their own will and pleasure. Men, actuated by the most gene-

rous motives, have done much during the last few years to improve the condition of the English sailor: should not the Government, taking another course of action, endeavour to discourage by penal laws the fraudulent manœuvres of the low lodging-house keepers, and thus promote the establishment of respectable domiciles, which will not speculate on the innocence of the sailor?

A nation, the independence of which is so completely based upon its sea-service, has, of course, the strongest interest in protecting by efficient measures the men who devote themselves to the defence of the country. Great Britain's real ramparts are neither her wooden vessels, now discarded, nor even her iron ships, the superiority of which over other armoured navies is still a doubtful one. No! her true stronghold must be sought for in the brave hearts of her seamen. Surely, then, it should be the duty of the State to defend the honour and comfort of the sailor against the birds of prey in the great towns, more inveterate against his person and property than the monsters of the sea would be against his helpless body.

By the side of the Sailors' Home stands the Sailors' Asylum, which is supported by the same philanthropic society. This latter institution is entirely of a charitable nature; it is intended to provide board, lodging, and clothing to poor sailors of every nation, and also to find work for them. Since 1827, 43,900 toilers on the sea, altogether destitute, have found a

temporary shelter in this port of refuge. Surely this work, being as it is of a cosmopolitan character, should receive assistance from all nations. Indeed, several foreign consuls, impressed with the kind attentions that have been paid to sailors of their respective countries who were reduced to the last stage of indigence, have forwarded pecuniary aid. But the managers of the Asylum complain that, up to the present time, France has done nothing for them, although they have done much for French sailors. Other English institutions, likewise supported by voluntary contributions, undertake to support the male and female orphan children of those who have been constantly exposed to the fury of the ocean. This solicitude manifested by a maritime and mercantile nation for sailors as a class, testifies how much their services are recognised and honoured. But it is only on board ship and amidst the adventures of the sea that the lives of these men, to whom England owes so much, can be thoroughly studied. We will, however, now especially review the system of nautical education.

CHAPTER IX.

HOW SHIPS ARE PRODUCED—WOOLWICH DOCKYARD—A GALA-DAY THERE—FROM WHAT CLASS OF THE POPULATION ARE SAILORS DRAWN?—ROMANCE AND REALITY OF MARITIME LIFE—HOW ILLUSIONS DISAPPEAR AT SEA—DUTIES OF THE SEAMAN AND THE CABIN-BOY—THE NEW TRAINING SHIP AND THE STREET ARABS—ORIGIN AND HISTORY OF THE "CHICHESTER"—THE "CASUAL WARD" AND THE BOYS' REFUGE—WANDERING LIFE OF CHILDREN IN THE STREETS OF LONDON—THEIR CHARACTERISTICS—THEIR APTITUDE FOR THE SEA SERVICE—THE TRAINING SHIPS FOR THE ROYAL NAVY—NAUTICAL EDUCATION, TERMS, AND SIGNALS—DIFFICULTY FELT IN RECRUITING THE NAVAL FORCES—DESERTION OF SAILORS—CAUSES FOR THIS STATE OF THINGS—THE SAILOR'S FUTURE IN ILLNESS AND OLD AGE—THE "DREADNOUGHT"—THE FUTURE OF THE BRITISH NAVY.

In the eyes of the English sailor every vessel is of the feminine gender; each of them considers himself as it were the *fiancé* of the wooden or iron-ribbed water-nymph whose wandering lot he shares over the wild waves.* Until quite lately, all the line-of-battle ships belonging to Great Britain came out of the royal dock-

* It is certainly a cause for surprise that the feminine gender should be used for all inanimate objects moving on the water, as it is contrary to the general rules of the language; but it is still more astonishing that a war-ship, in spite of its masculine name, *man-of-war*, should follow the same grammatical usage, and be always called *she*.

yards. The floating citadels, of which now so little is thought in comparison with the iron-clad frigates which have taken their place, were all constructed at Deptford, Woolwich, Chatham, Sheerness, Portsmouth, Plymouth, or Pembroke.

In 1863 I was present at the launch of the last wooden man-of-war which the Lords of the Admiralty ordered to be built at Woolwich Dockyard. The young giant lay peacefully in his cradle. What else can I call a stone basin laid completely dry, lined with oak, and covered at a great height with a glass roof rounded in the form of an arch? About three hundred persons, male and female, had been invited to take a share in this nautical ceremony. They were scattered about over every part of the vessel, both above and below decks, wondering at the cavern-like recesses of the wooden steed destined ere long to bound over the waves. There is so much to see in a line-of-battle ship—the mess-room, in which the tables are let down at meal-times, and are drawn up to the wooden ceiling during the rest of the day, so as not to impede moving about; the sleeping-cabins, where the place of each marine or sailor is indicated by a hammock carefully folded up and hooked on to the sides of the ship; the officers' cabins, and the store-rooms crammed with cordage, provision of food, and munitions of war. What singular effects of light are developed, the beams of day diminishing as we descend from one deck to

another, down to the deep and dark hold! Both above and below, everything wears a festive air. Musicians, playing their brass instruments with a vengeance, have been wishing welcome over and over again for more than an hour to the new-born child of the British navy. The ship, at a given signal, is cut loose, and glides, impelled by its own weight, down an inclined plane, to hurl itself into the bosom of the Thames. While in motion it received its baptism under the form of a bottle of wine, which was broken on its bows. It was somewhat of a solemn moment: the water, violently driven back, rose in waves like the sea, and, amidst shouts of enthusiasm, the sailors unfurled the flag of Great Britain, its folds majestically spreading out in the breeze. The hurrahs of the crowd were soon succeeded by an almost religious silence. The emotion which is excited among the spectators at the launch of a man-of-war is doubtless connected with some kind of presentiment of the dangers she is about to brave, and the destruction which it may be her fate to bring on others. To what fortune is she destined? Will she bear a part in some naval engagement, and if so, against whom? Is victory or defeat to be her future lot, or merely the obscure destiny of so many other line-of-battle ships, which, though built only lately and at great expense, have never received their baptism of fire, and indeed have scarcely ever floated on the seas? But

the newly-launched ship, which at first made such a commotion in the foaming river, soon floats quietly, an inert mass. It had neither masts, sails, nor rigging, and as one of the sailors said, "This big baby of the English fleet did not know yet how to use its limbs." We were of course compelled to leave it floating powerless in the middle of the river, and to regain the shore by means of boats.

Since the introduction of the iron-clad fleet, these matters are managed very much in the same way. But now, a considerable proportion of the monsters of the new system, as the *Warrior* and *Minotaur*, are not built in the royal dockyards. The Government has found it more to its advantage to negotiate with some of the large iron-works on the banks of the Thames; among others, the Thames Iron Ship-building Company, which has built ships of the same metal for the merchant service, especially for the Peninsular and Oriental Company, which is one of the largest establishments of the kind in the world.

When the ship, whether of iron or wood, is launched and rigged, she of course needs a crew to manage her. By what class, then, of the population of England is the English navy manned? Before answering this question, it is necessary to point out the essential difference which exists between the royal navy and the army. In the army, officers' commissions are bought and sold; in the navy, things are differently

managed, and promotion depends on education, merit, and seniority. The almost insuperable line which in the army separates the commissioned and non-commissioned officers, at any rate used not to be so strictly drawn in the navy, and some famous British admirals have entered as cabin-boys. The cadets about to enter the service undergo an examination at the Naval College at Portsmouth, and enjoy certain privileges, but they form by no means an exclusive body. Aristocratic names are no doubt to be met with in what is called here the *Navy List;* but still it is easy enough to see that it is the middle class especially which furnishes pupils to the naval schools, and that the lower class supplies the mass of voluntary entries for sea-service. If this is the case in the royal navy, we have still stronger reasons for expecting to find the same conditions holding good in the merchant service. It would be as well also to consider some of the motives which induce the Englishman to become a sailor.

It must certainly be confessed that many a man and lad enters himself on board ship because he has no other calling, and no other resource. This, however, is not generally the case, and, as a matter of fact, an inclination and predisposition for the sea is more often the ruling cause. Among the boys born all along the coasts of Great Britain there are many on whom the external *surroundings* exercise a kind of charm. The passing sails seen against the blue sky, the cloudy

beauties of the horizon, the eternal restlessness of the ocean, the mirage of far-off countries presenting itself to their view in the flattering tale of the time-worn mariner,—all these pictures are before their mind's eye, even in sleep. "The ocean draws them," say the dwellers on the sea-shore, "just as a pond attracts young ducks." In vain do their families often strive against this too natural inclination. I knew a young lad of twelve years of age in the county of Norfolk who was thus, as it were, bewitched by the sea; on two occasions he escaped from his father's house, to which he was brought back just as he had concluded an engagement with a ship's captain; the third time his father was too late,—the vessel in which he had entered had just sailed. Others, again, are led away by reading novels of nautical life,—so rich a branch of English literature, extending its influence even to the villages,—and as fiction often takes a stronger hold of the youthful brain than even facts themselves, it is by no means rare, even in the interior of the country, to find young imaginations tormented with the nautical fever. And yet, alas! it must be added, these enthusiasts do not always make the best sailors.

After all is said, life at sea is both monotonous and prosaic. There is no doubt that the course of the ship constantly brings the sailor into the presence of the most sublime spectacles of nature; but he has but

little time to view them. Laborious duties and manual labour absorb almost all his attention. The voice of the ocean may speak to him of liberty, but instead of this, he finds on board his ship a hard servitude. Sound sleep, the slave's only comfort, does not fall to the share even of the cabin-boy, interrupted, as he may be, at every hour of the day and night by his captain's voice. The sailor, compelled to quit his berth and jump up on deck whenever the exigencies of the sea require a change in working the ship, is at the beck and call of his chief, and at the mercy of the elements. Add to this the regular night-watches under a sometimes glacial sky, the many unrelished duties, the imperious orders, the severe punishments, and we may readily conceive how the bright dream of poetry soon vanishes away before the hard facts of sober reality. Once on the wide waters, the cherished romance disappears page by page, and the young novice feels inclined in his heart to say to the sea, "Thou hast deceived me." But there he is, and there he must remain. Induced by necessity, and a certain amount of *amour-propre,* he sticks to the profession that he feels he has too ardently taken in hand. Nothing on earth would induce him to confess his disappointment, and to avow to his family and friends that he has made an unfortunate choice; but from this time forward, at least for a very long period, this disenchantment overshadows his life like a cloud. What

vigour have we a right to expect from a spirit thus too late undeceived, its natural energy being constantly extinguished by the disgust of disappointment? There are, on the other hand, many youths who are sent to sea by their relations, in order to reform various bad practices they have fallen into. The greater part of these scapegraces make excellent seamen in the end. Having no fanciful illusions to get rid of, they are ready to turn their hands bravely to their material duties, and seek to profit by all the positive advantages to be derived from the laborious life to which they have been, so to speak, condemned.

A consideration of this latter circumstance has doubtless given rise to a generous and benevolent experiment. Having heard it mentioned that a *training* ship, intended to receive a collection of little "street Arabs," and to educate them as sailors, had been stationed for some time off Greenhithe, I bent my course to this little village, situated on the banks of the Thames. On arriving at the pier, I soon caught sight of a frigate which was just being moored some distance from the bank; this was the floating-school I was looking out for. I was obliged to hire a boat, and after a short row,—during which I noticed the Sailors' Church on the river, an old vessel fitted out for the requirements of divine worship, and devoted to the use of sailors who wish to attend a religious service without quitting their accustomed element,—I stopped at the

lowest step of a wooden staircase leading up to the deck of the ship I was intending to visit. On the upper deck and in the rigging of the vessel some nice-looking lads of interesting appearance, clad in blue trousers, a large woollen shirt of the same colour, and caps on which the word "Chichester" (the name of the frigate) was inscribed in yellow letters, were engaged in various manœuvres. Is it possible that these lads can be the abandoned foundlings of the streets of London, who are called by the English "Arabs," on account of their savage and vagabond habits?

I was received on board by the commander, Mr. A. H. Alston, a young and intelligent officer of the royal navy. He was good enough to show me with much courtesy the whole interior of the vessel, and the arrangements which had just been made for converting it into a naval school. The *Chichester* was not born yesterday—indeed, she is twenty-six years of age; but, like so many other men-of-war built by the orders of the Admiralty, she has never seen any service. Her fate would, no doubt, have been to rot at her moorings in the obscurity of some one of the dockyards, if the Government had not shown their good feeling by *lending* her (is not this, in official language, a synonym for *giving* her?) for the purposes of the moral experiment which was just then being tried on the Thames by some enterprising members of a charitable institution. Since 1852 an establishment has existed in

Great Queen Street, London, forming a refuge for homeless and destitute boys, supported by voluntary contributions, and managed by a committee, of which the Bishop of Ripon is the president. A branch of this committee formed the body who undertook to negotiate with the Lords of the Admiralty in respect to the ship *Chichester*. When the vessel was placed in the hands of these gentlemen, she was nothing but a mere carcass; the appliances for masting and rigging her were, it is true, furnished by the royal dockyards, but only on the condition that the cost of fitting out, amounting to £2,000, should be subsequently defrayed by subscriptions from the country at large. The three masts and the rigging which now tower over the *Chichester* form, of course, a field for manœuvres quite essential to the education of ship-boys. The main deck has been likewise adapted to the requirements of the service; it is divided into a school-room, a mess-room, and a cook's cabin, in which two boys dressed in sailors' garb superintend the stoves and boilers with a certain air of importance. In fact, the principle is laid down that all the work of domestic economy is to be done by the hands of the pupils themselves. The lower deck is, during the night, occupied by the hammocks, and forms the dormitory. These arrangements, although still very incomplete, have already entailed an expense of £3,000, and the subscriptions have not yet covered a third part of this

sum. But the directors have entire confidence in their plans:—has money ever been found wanting in England for any really useful work? Is the idea a good and practicable one? The whole question of success lies in the answer to this question.

In order to better judge of this new naval institution, it will be as well to recur for a few moments to the circumstances under which it was founded. At the time I am writing, it is about a year back that an English author, Mr. James Greenwood, called the attention of his fellow-countrymen to the *casual ward* of the workhouse, the resort, during the night, of all those who, living in London on what chance brings them, find themselves without a bed to lie down upon, or a roof to shelter them. Instead of depending upon vague and second-hand inquiries, Mr. Greenwood resolved to obtain admittance personally into this rendezvous of all that is poor and miserable. He disguised himself in borrowed rags, and, under a false name, had the courage to spend a night amidst the *habitués* of the "casual ward." The detailed account of all that he saw and heard there made much noise in England, and produced an immense effect. Thanks to his daring, it became known that in these dens children were mixed up pell-mell with men of the most immoral character. This incident moved many a charitable soul, and pains were taken to seek out some of the little vagabonds who were accustomed to sleep in the casual wards of London,

or in other and perhaps still darker resorts. On the 14th July, 1866, these lads were invited to a supper which was provided for them at the "refuge" established in Great Queen Street. About two hundred of them responded to this appeal, and the meeting had features of so touching a character, that many of the ladies present were scarcely able to restrain their tears at the sight of so many children without house or home. The chairman addressed various questions to the little Bohemians, in order to find out the cause of their wretched state, and the remedy that would be most applicable for it. Among others, he asked: "If a vessel was moored in the Thames for the purpose of forming a naval school, how many among you would like to join it?" All held up their hands.

Immediately on the *Chichester* being placed at the disposal of the committee, a ceremony took place at Blackwall to inaugurate this new nautical mission. Since then she has been moved down rather closer to the sea, at least as far down as Greenhithe, and there she is to remain. At the time I am writing it has already gathered in fifty young Arabs, only too glad to pitch their tents upon the water; eighty-five more are expected, and before the end of the year the managers fully hope to be able to give an asylum to two hundred homeless children. The praiseworthy proposition of the committee is to divide their resources among three classes: a hundred children will remain

in the "refuge" in Great Queen Street; two hundred will be sent on board the training ship to be educated, and to become familiarised with life on board ship; and a country establishment, with one hundred acres of land annexed, will serve as a kind of model farm to instruct a hundred more youths in agricultural operations.

Some of the new inmates of the *Chichester* have spent two or three years in London without ever sleeping under a roof, not even in the casual ward. Preferring their liberty to the dismal lodging provided by public charity, their custom was to lie down either in the ruins of some of the houses that are constantly being pulled down in London, or on a door-step, or under the arches of a bridge. Thus there are in the capital of England many thousands of children in a state of destitution, some of whom have left the roof—too often not much of a paternal one for them—under which it was their fate to be born; others who have been abandoned by their relations, or have been left upon the streets by the death of their parents. Well, the street never rejects them; it adopts them and rears them. To these little ones London is a desert, and though lost in the drifting sands of the crowd, they never fail to find their way. The greater part of them contract a singular taste for this hard and almost savage kind of life. They love the open sky, and at night all they dread is the eye of the policeman: their young minds become fertile in resources, and glory in their inde-

pendence in the "battle of life;" but, if no helping hand is stretched out to arrest them in this fatal and down-hill path, they surely gravitate to the treadmill and the prison. How could it be otherwise? And at whose door does the blame lie? Partly, perhaps, to absolve the conscience of the community from a sense of remorse, English moralists have lately been directing their attention to the means best fitted for helping these little "Arabs." The question is, What are these lads good for? It has been considered, and I think justly, that they are well fitted for the sea-service.

Adventurous and seasoned, as they are, to every privation, accustomed from the earliest age to depend upon themselves, and themselves only, are they not the very stuff out of which English sailors are made? With their erratic blood still coursing through their veins, will they not be ready and eager to wander over the watery waste? At all events, those who have been already admitted on board the *Chichester* completely justify these hopes. Captain Alston gives an excellent account of their intelligence, their activity, and—what was perhaps hardly to be expected—of their submission to discipline. I have myself seen them applying themselves with due order and energy to certain manœuvres of seamanship, under the direction of three brave sailors who guide and instruct them. If this experiment succeeds as well as we have every reason to expect, the good work will of course be

extended, and there will not be one single vessel only, but a little fleet of ships moored, some in the Thames and some in the other ports of England, which will gather in the youthful population wandering homeless in London and other large towns. At a time when both the naval and merchant services find it every day more difficult to procure men, Great Britain, in this plan, will have found out an excellent source for recruiting and invigorating her nautical forces.

The establishment of a *training ship* was certainly not a new idea. About fifteen years ago, Captain Harris, hoisting his flag on board the *Illustrious* (a ship of the line), introduced in it, under the sanction of the Admiralty, a complete system of education. This is still carried on with the greatest success, under the same enlightened chief, on board another ship of the royal navy, the *Britannia*. It would take too long a time to enter into all the details of this technical education. Suffice it to say, that in these floating schools the time of the young mariners is pretty equally divided between study and bodily exercises. The system is very much the same which they are now seeking to apply to the merchant service. The course of instruction for the young "Arabs" on board the *Chichester* must be doubtless a little modified. These street-boys have no need to learn the great-gun practice or the sword exercise, and several other war-like manœuvres which form a considerable portion of

the operations on board a queen's ship. Neither is it any part of the plan that they should be turned into scholars: when they have learnt to read, to write, and to reckon, and have become a little familiarised with life on board ship, then the time has come to enter them in some merchant vessel to go and seek their own livelihood on the wide ocean.

The intention of the committee is to keep them on board the *Chichester* and instruct them for one year. After this space of time the pupils of the institution would not be altogether strange to handling the various appliances on board a ship. The novice who has but just quitted the shore has, of course, everything to learn, and first and foremost even the names of the different parts of the rigging, and other things which are used in navigation. The most curious thing in this maritime vocabulary is the tenacious force and dictation exercised on those that use it by their early recollections. It is all very well for Jack to boast that he has *sunk the land*, but he cannot altogether free himself from the numerous associations of ideas which are more or less connected with it. If you ask for the proof, it is simply this: the greater part of the inanimate objects with which he is incessantly being brought in contact on board ship obtain designations from him which are borrowed from the names either of domestic animals or of some of the usages he has known on shore. Thus the wooden house floating over the ocean

is a sort of Noah's ark, in which the mariner carries about with him the whole train of animated nature.*

How numerous are the practical acquirements of which the young sailor has to make himself master! When two vessels meet in the open sea they generally *speak* one another; but this is not done by the voice. In rough weather, and at some distance off, it would be evidently impossible to hear it: it has been therefore found necessary to have recourse to a conversation by means of signs. This language was still somewhat confused and rather imperfect when, a few years back, a kind of code was formed to regulate the use of signals in British ships. A committee, composed of members named, some by the Board of Trade, and others by the Admiralty, the Trinity House, Lloyd's, and other noted institutions, set to work, and began by examining into all the different systems of nautical signals. Marryatt's system was the one most followed in England, in France that of Reynold, whilst Rogers's plan prevailed in the United States. The committee proceeded on an eclectic plan, and thus laid down the formula of a code of signals which, without being compulsory, is considered in Great Britain as entirely a national one. An acquaintance with these emblems

* The horse, for instance, is met with, at least in recollection, in the "horse-blocks," the dog in the "dog-vanes," the cat in the "cat-heads;" and the same coincidence holds good with regard to many other nautical appliances.

constitutes, of course, one of the branches of the science of navigation.

When an English ship wishes to speak with any other vessel, she hoists to a given height certain flags, the number, shape, position, and colour of which vary according to the nature of the message which it is wished to convey. In order to avoid confusion, it has been decided that no more than four flags shall ever be displayed at the same time; but, as these four ensigns are quite inadequate to convey all the ideas required, it is almost always necessary to replace them successively by others which are kept ready in reserve at the foot of the mast. There are, in fact, eighteen flags, representing the eighteen *consonants* of the alphabet, for in this enigmatical language all the vowels are suppressed. By the help of this small number of letters, or rather emblems, grouped according to ingenious combinations, means have been found to signal the names of fifty thousand vessels,* and about twenty thousand words or

* This number is certainly likely to give rise to surprise, and demands some explanation. From the returns taken in 1855, the total number of English ships scattered about over every sea amounted to the enormous figure of 35,000. As, on the other hand, 1,500 new vessels on an average come out of the shipbuilding yards of Great Britain every year, and are added to the merchant service and the navy, it was thought necessary to select 50,000 emblems to designate the vessels of all kinds then existing, and those that would be built within but a short space of time in the United Kingdom. Thus, following out this calculation, at the end of 1867, about 53,000 ships will be navigating the seas under the British flag.

nautical phrases. Two English ships meeting at the furthest extremity of the globe can thus exchange their greetings, and as in the course of time the British code of signals will doubtless be adopted by other nations also, a universal language, that Utopian dream, will at least exist at sea.

The repugnance to entering the service of Government, now too generally manifested by English sailors, is a symptom which may have an untoward effect on the future of the British navy. For the honour of human nature, it must be confessed that neither dangers nor privations have much to do in turning nautical predilections in a different direction. In bygone days, when the *tar* was badly fed, badly clothed, and harshly treated, the fleets of the United Kingdom never wanted for strong arms. Then it was that bright rays of glory shed their lustre over the sea. Now-a-days the men are better paid, and the entire system of somewhat brutal punishments has been much mitigated. Various careful hygienic measures have singularly ameliorated the sanitary conditions of a man-of-war, and yet the Government has much difficulty in procuring sailors. What can be the cause of this anomaly? That there has been progress made in the naval *régime* there can be no doubt, but yet this progress has still remained in the rear of the march of public opinion, and is inadequate to the habits and requirements of the working classes in our epoch. Is the merchant service, con-

sidered by itself, more fortunate in the ability to man its ships? Indeed, no. A large number of foreigners are now serving on board English merchantmen, and it becomes every day more and more difficult to attract able seamen capable of undertaking the duties of navigation. It once seemed as if the process of *seeking* a fortune found more merit in the eyes of the venturous ones than even its *possession;* but such is not the spirit of our more material age, and now-a-days but few are found enterprising enough to peril the substance for the shadow.

Not only is it a fact that the English at the present time show a less inclination to enter the navy than was formerly the case, but an increasing number of them, after having signed their engagements and lived some time on board a man-of-war, desert the British flag. It is not that they run away from the sea, for in many cases they offer their services to others, either at home or abroad. The fleet of the United States, for instance, is supplied to no very small extent with numerous seamen who have gone to seek on the other side of the Atlantic what they consider better wages, and an immunity from certain degrading punishments. What would take place in the case of war breaking out between Great Britain and the United States? Would the English sailors entered under the American flag turn their arms against their mother-country? And if this should unhappily be the case, would the rigorous

military code come into application, which declares that deserters taken prisoners under an enemy's flag shall be hanged? In either case it would be a great source of embarrassment for England, and perhaps an outrage on humanity might follow. If there were no other consideration than this, may this one be sufficient to ever ward off a fratricidal struggle between two nations linked together by the ties of blood and by so many almost sacred interests!

If the naval profession has thus lost in Great Britain the prestige which it had during the last century in the imagination of the people, the cause must be that too few advantages are offered in exchange for a painful self-devotion. Jack is certainly brave and staunch, but still he likes to be recompensed for the dangers to which he is continually exposed, for the monotonous life to which he is condemned, and for the liberty which he gives up. But after all, what is the future of a young ship-boy who enters as a volunteer into the royal navy? He is not, it is true, altogether restricted from promotion, but how very few sailors there are who are able, without either favour or patronage, to attain to any honourable rank. One of the oldest sailors in the English fleet visited lately the port of Cork on board the *Warrior*. John Midgeley (for this was the name of the brave veteran) had served at sea for fifty years, he had shed his blood in many a naval engagement, and yet—he was still

nothing more than a mere petty-officer. Another veteran, John Ranger by name, who was eighty-six years of age, and had fought with Nelson at Trafalgar, died lately, poor and neglected, in the workhouse at Guildford. It must be allowed that examples of this kind will not conduce much to promoting the enrolment of volunteers.

But, at any rate, does the merchant service recompense its sailors any more liberally? So far from this, they are not very highly paid, are berthed in dark and offensive cabins, are fed with dry and coarse provisions, and too often wear themselves out in making the fortune of the ship-owner. True it is that these very ship-owners often become the earliest victims of their avarice and their indifference to their sailors as a class. Shipwrecks increase, and there is every reason for attributing these terrible catastrophes to the inexperience of the men to whom, in default of better, merchants are compelled to intrust the fortune of ships laden with valuable merchandise. It is hardly to be credited that the larger portion of English sailors do not even know how to swim. The nation which is more surrounded with water than any other in Europe, and has by far the greatest intercourse with the sea, is the one of all others which, by a strange inconsistency, most neglects the acquirement which brings safety in case of accidents on the water. And yet Jack loves his trade. As long as he is young, he holds on through

all the squalls of fate, and defies every misfortune. Life at sea strengthens his feelings of nationality; he glories in bearing the British flag over distant waters, and he reflects, with a heart swollen with pride, that he carries with him on board his ship his country and her privileges. All too soon, however, come at last, first maturity, and then old age. If in good health, poverty is his only prospect; if he is sick, a hospital awaits him.

The most curious establishment of this kind is unquestionably the *Dreadnought Hospital-ship*, devoted to the service of sailors, and lying off Greenwich in the track of all the vessels entering the Thames. Just as in the case of the training ship, I had to put off in a rowing boat, which conveyed me to this floating hospital. This institution was founded during the winter of the year 1817—1818, at a time when a large number of sailors, afflicted with maladies more or less severe, were wandering helpless about the streets of London. The first ship that was converted into a hospital for merchant seamen was the *Grampus*, which was moored off Greenwich. In 1830 this vessel was found too small for the number of patients, and, on the other hand, the resources of this charitable work had largely increased, fed, as usual, by voluntary contributions. The committee, therefore, obtained from the Government the grant of a line-of-battle ship, the *Dreadnought*, which was itself replaced in 1857 by the *Caledonia*.

But as the reputation of the *Dreadnought* was so long and well established, its successor consented to be re-christened, and to take the old name. It was, therefore, the interior of this new *Dreadnought* that I was about to visit.

It is interesting to see the way in which the old man-of-war has been turned to account, and the uses to which they have been able to adapt it. Who would believe that besides accommodating a large number of patients, room has been found for lodging for the surgeons, a nice-looking chapel, an anatomical museum, a dispensary, a linen-room, and various other departments necessary to the duties of a hospital? The first ward of the infirmary, occupying the upper deck, is known by the name of the *accident ward.* This is, in fact, the place where sailors are received who are wounded or mutilated by any of the accidents too common on board ship. If there was no such institution as this, many of these men would have to be carried up as far as London, and even then might have to wait several days before they were admitted to a hospital. The *Dreadnought,* on the contrary, lies directly in their track, and the question asked of each patient is not what countryman he is, but what he is suffering from. Seamen of all nations are admitted at once, without even any letter of recommendation. In fact, I noticed many men of colour.* All along

* Since its foundation, 94,879 sailors have availed themselves of

this large ward the contiguous rows of beds, on which were stretched the forms of suffering humanity, the small windows cut in the sides of the ship, the glimmering reflection of light thrown up the water of the river, all contributed to produce an effect which was at once extraordinary and melancholy. Two other decks are devoted to the treatment of various maladies. English hospitals are not, as a rule, assisted by Sisters of Charity; nurses, dressed in black, but in the usual fashion of other women, here watch over the sailors, as one of them gratefully said, with hearty tenderness and devotion. One of the best features of this institution is that it does not get rid of its inmates as soon as the more active symptoms of their malady have been overcome, but, on the contrary, keeps them until they are completely convalescent. The sailor is often a man who has no home on shore, and no friendly roof to shelter him: where then could he go to recover his lost strength? I left the *Dreadnought* full of a feeling of admiration for English charity, but at the same time both sadly and painfully impressed. I felt that I had had a glimpse of one of the dark sides of a sailor's life.

It will not do to draw any very rigid conclusions

the hospitality of the *Dreadnought;* 2,418 of whom were Hindoos and Lascars, 524 Africans, 53 Chinese, without reckoning the natives of New Zealand and New South Wales. The French figure in this list to the number of 499. The institution enjoys an annual income of more than £16,000.

from the state of difficulty and suspense in which one of the vital branches of the public fortune across the Channel is now plunged. The English sea-service is in a state of transition, but it is also in a state of renovation. And how could it be otherwise? The very material of construction is altered; steam has in a great measure superseded the sail, and now-a-days lends wings to ships of iron. Man makes machines, but machines, in their turn, modify the nature and characteristics of the men who guide them. These ships of metal, powerful as they are made with all the latest discoveries of science, have for their commanders and officers men shaped after the model of the vessel which they govern—correct, methodical, polite, cold as the armour which protects them. The sailors themselves do not now in any way, as in old times, constitute a class by themselves. Education has made its way even on board ship, and will increasingly shed its influence over the sea, where once ignorance and heroism were thought inseparable. Henceforth the English sailor will in no way show his fancied superiority over his fellow-citizens by swearing his rude sea oaths and despising landsmen. But in proportion as the moral faculties of the *personnel* are elevated, will it not also be found necessary to modify the maritime code, and to pay more respect to the human dignity of the sailor? Let the English go on preserving in their dockyards, as in a kind of museum,

the relics of their victories; let them still proudly show to foreigners their time-worn war-ships, the names of which are bound up with so many a famous sea-fight; they are free to do this, and nothing can be more natural; but these ancient thunder-clouds of war are now but mere shadows, and a really proud nation cannot live on recollections. England, on the contrary, should, to some extent, detach herself from her obsolete naval traditions, and follow bravely the current of progress; thus will she most effectively verify to the world her old title-deeds to glory.

Is there not, too, on the other hand, a high social mission for the merchant service of Great Britain to carry out? Merchantmen, visiting every extremity of the globe, often bring back to the port of London Lascars, Chinese, Malays, and Africans. It constantly happens that a captain touching at some far-distant isle or continent applies to the natives of the coast to fill up the vacancies in his crew which are caused by death or desertion of some of the English sailors. All goes well during the voyage; and so long as the requirements of the ship call for the employment of these auxiliary forces, not much notice is taken of the colour of the hands which hoist the British flag; but when the vessel is safely arrived in the ports of London or Liverpool, what kind of treatment do these foreign strangers meet with? Left to their fate in the streets of a great city, expelled from the ship which

brought them, and on board of which they served, they often draw out an existence bordering on beggary. In the docks, those great markets for maritime labour, English sailors are naturally preferred to them, and many of them thus lose any chance of ever revisiting the land which gave them birth. They wither away in some dark London alley, or in one of the hospitals, longing for the bright sunshine of their native land, and cursing the ill-omened fate which led them to the foggy Thames. Some captains of merchant vessels, however, state that the services of these men are by no means to be despised. They are sober and accustomed to the sea, and it only requires a little patience to mould them to the discipline and teach them the skilled manœuvres of the British sea-service. Will England allow such a good opportunity to escape her as this might be for recruiting her naval forces? The whole world is open to her to select from, and even in the far East—experience proves this—strong arms are willingly offered to aid in the peaceful conquest of the seas. Would not this procedure prove also an excellent means of spreading the blessings of civilisation among the boldest and most intelligent representatives of the various races which people the face of the terrestrial globe? This policy is recommended to Great Britain, not only by the respect she should pay to progress, but also by the well-understood interests of navigation and commerce; for the ocean—

that connecting link between far-off lands and isolated races—proves itself to be the workshop where we can best utilise the diversified elements of the great human family.

CHAPTER X.

THE FORMER UNPROTECTED DIVING—FIRST ESSAYS TO EXTEND THE POWERS OF MAN UNDER WATER BY EXTERNAL MEANS—WILLIAM PHIPPS—THE DIVING-BELL AT THE POLYTECHNIC—PLYMOUTH AND ITS SOUND—THE BREAKWATER AND THE DIVING-BELL—NATURE OF SUBAQUEOUS OPERATIONS—THE WORKING OF THE BELL—HOW THEY BREATHE AND HOW THEY SEE AT THE BOTTOM OF THE OCEAN—SANG-FROID AND RECKLESSNESS OF THE DIVERS—HOW THE MEN AT THE BOTTOM OF THE SEA SPEAK TO THOSE AT THE SURFACE OF THE WATER—DOINGS IN THE BELL—MODE OF SHIFTING ITS POSITION AT WILL—WHO INVENTED THIS APPARATUS?—DR. HALLEY AND HIS DIVING-BELL—SMEATON—INTRODUCTION OF THE AIR-PUMP—OPERATIONS IN THE DOCKYARD—SUBMARINE BUILDING—BRUNEL THE ENGINEER—HOW ROCKS ARE BLOWN UP AT THE BOTTOM OF THE SEA—THE DIVING-BELL HAS NOT YET FOUND ITS GLAISHER—ACCIDENTS TO DIVERS—LIFE UNDER WATER—LEGEND OF THE DIVER AND THE SIREN.

In all ages one of man's fondest dreams has been the desire of descending to the bottom of the sea, for the purpose either of exploring its mysteries or gathering up its treasures; and yet, up to the present time, we are acquainted with but little more than the surface of the great desert of water which covers three-quarters of our globe. True, the fancied imagery of the poet had built ideal palaces under the wave; had carved out grottoes of coral, and paved with mother-of-pearl the bed of the ocean; but, as a matter of fact, the boldest

diver had caught but a hasty glimpse of the dark reality of the abyss. And how could it be otherwise? What can man, left to his own personal resources, do against the vehement mass of submarine waves? The art of unassisted diving under the water is found to be limited by our natural constitution; it has not, therefore, made much progress. The accounts of English travellers show us, however, that this physical effort can be much facilitated by practice from the very earliest age. They relate that the natives of the islands of the South Seas swim and dive like fishes. If a nail or any other small object is thrown into the water before them, they jump in to search for this slender trophy, and will bring it out from the bottom of the gulf with a triumphant air. They also appear to enjoy their presence of mind when under water quite as much as when on land.* The most celebrated among the divers of the East are those of Ceylon, who seek under the sea for the pearl-oyster. Accustomed from their very infancy to sport amid the depths of the ocean, they have been known to descend under the waves as many as forty or fifty times in the course of one day. This labour is, however, so painful to them, that, on

* On one occasion an anvil fell from a ship into the sea; the natives of the island found this mass too heavy to be raised to the surface of the waves. What did they do? Some of them dived down repeatedly to the bottom of the sea, and by dint of rolling the anvil over and over they managed to bring it to the shore.

returning to the surface of the sea, they often discharge from their mouth, nose, and ears water mixed with blood. The Indian diver is exposed to many a danger, the greatest of which is perhaps the permanent injury to health, but that most dreaded is the attack of sharks.

Experience thus proves that, however painful and injurious it may be, the suspension of the respiratory functions may be prolonged by habit; but the question is, to what extent, and how long? There is, I believe, no authentic instance of a diver having remained at the bottom of the sea more than two minutes. This practice, when left to the unaided powers of nature, may be a curious exercise, and even a glorious means of saving life, or in certain cases, as with the pearl-fishers, a useful and profitable calling; but it could never exercise any great influence on industrial enterprise, or on the science of marine engineering. There has thus been in every age a strong desire to invent certain appliances which should be adapted to assist man's bold efforts under water.

The appliances now in use are the diving-bell and the diving-apparatus. The English are not the only nation which have made use of these instruments; but, as Great Britain is the country which is more surrounded with sea than any other in Europe, as the number of its ships and the conformation of its coasts expose it more than any other to the perils of shipwrecks, it is very natural that our neighbours should,

for some long time back, have directed their attention towards perfecting the artificial means for submarine labour, in order both to strengthen their ports, and to recover the lost treasures hidden in the depths of the ocean. About the year 1663, an Englishman named William Phipps, the son of a blacksmith, invented a plan for recovering from the sandy bottom of the sea the treasures out of a Spanish vessel which had sunk on the coast of Hispaniola. Charles II. lent him a ship and all that was necessary for his enterprise; but the matter did not turn out successfully, and William Phipps fell into a state of the greatest poverty. Notwithstanding this, nothing could discourage his ardour, and to set himself afloat again he opened a subscription-list in England, to which the Duke of Albemarle was one of the subscribers. In 1667 Phipps embarked in a ship of 200 tons burden, having undertaken beforehand to divide the profits between the twenty shareholders who represented the associated capital. At first starting his search proved altogether unavailing, and he was just beginning to despair, when he succeeded in falling in with the golden vein. The fortunate diver returned to England with £200,000; £20,000 he kept for himself, and no less than £90,000 came to the share of the Duke of Albemarle. Phipps was knighted by the king, and became the founder of the noble house of Mulgrave, which has played no inconsiderable part in the affairs of the United Kingdom.

Searches of this kind, but facilitated by mechanical means of very different power, are now-a-days extended not only all along the coasts of Great Britain, but in every sea over which floats the British flag. There is scarcely a single port in the kingdom which is not provided with its diver and its apparatus for subaqueous descents. The services which these new appliances render to navigation, marine architecture, and the public property generally, are really incalculable; we may easily judge of this by some considerations of what has happened in bygone days, compared with the present state of things. We must begin with the *diving-bell*, the first in order of date in the history of submarine invention.

There is an establishment in London called the Polytechnic Institution, which aims at rendering science amusing. There, in a long hall in which are displayed various models of machines and useful inventions, stands a large zinc reservoir filled with clear water; the centre of this reservoir is dug down so as to form a well of some considerable depth, the mouth of which is marked on the surface by a bluish circle. To one of the iron columns which support a horizontal gallery a diving-bell is suspended by a crane and chain. On the outside it has the appearance of a bell-shaped hive of cast iron, and weighs, it is said, three tons; towards the other part of it it is pierced with loopholes solidly closed up with glass. Inquisitive persons, who do not

dread experiencing certain disagreeable sensations, are allowed to make the experiment of a descent. The entrance to the bell is by means of a staircase of a few narrow steps, and with the help of a hand-rope we hoist ourselves up to a wooden bench which is fixed all round the interior of this circular cage. I found myself in this way seated with three companions in a narrow space where there was scarcely room to breathe freely. Thank goodness, it was not long before the bell began to move: lifted by the crane, it described a half-circle, and stopped immediately over the bluish water indicating the mouth of the well. At the same time, we heard above our heads the panting breath of the air-pump which supplied us with intermittent puffs of the necessary element. The chains were let down, and the bell gently descended.

Up to this time we had experienced no extraordinary sensation; but at the moment when the bell entered the surface of the water I began to feel a loud singing in my ears, no doubt the effect of the pressure of the condensed air in the bell;* at this time we were half submerged. I think the really beautiful part of this invention is to find the water retreating from under one's feet, as if with a kind of respect. By the aid of

* This well-known phenomenon affects persons in very different ways, according to their constitutions. Some complain of much uneasiness, and feel as if their heads were bound round and tightly compressed with a circle of iron.

this simple apparatus, man makes at his will a void in the bosom of the liquid element. He says to the water, Begone! and it shrinks away. It is necessary, in fact, to recall to our minds that the bell is entirely open at the lower end, and that it is nothing but the pressure of the air which repels the intruding body of water. The light which makes its way through the glass loop-holes of this cell is bright enough to show every object; but as we go down deeper into the water, it assumes a greenish nondescript shade. I felt that I was passing through an atmosphere which was altogether novel to me, and my sensations had somewhat of the fantastic colouring of a dream. Our heavy machine had now entirely disappeared under the water in the hollow of the reservoir. Fancying myself at the bottom of the sea, I half expected to see some fish looking in at us with astonishment through the window; but alas for my illusion! I discovered no trace of any living being. The impressions made on me by my passage through the calm and oily-looking liquid were limited to some rather curious acoustic effects. My companions tried to talk; but, in consequence of the compression of the air, their voices scarcely reached my ear; indeed, I could hardly hear my own voice. The bell ascended, as it went down, with solemn slowness.

I wished in this experiment to make some little trial of my submarine powers, but, as I said to myself, the reservoir at the Polytechnic Institution is very different

from the sea, and I fully resolved to try again on some other watery field of action.

Two years ago, when at Plymouth, I heard that four or five diving-bells were at work every day in the waters of the Sound, close to the *breakwater*, where some submarine workmen were still engaged on that Titanic work. It seemed to be a good opportunity for me to make acquaintance with the bed of the sea, and I took the requisite measures. The next morning I bent my way to the old port, where they were unloading fish on to the quay, and there I chartered a boat. The boatman was a native of the town, but had, as it appeared, dipped his oar in many a distant sea. He told me that he had for some years exercised the same calling in Italy, and he seemed to me at first sight to be a man of some considerable experience. I confided to him the project I had in hand, and he did not at all consider it was impossible to carry it out. My old sailor was also an indefatigable *cicerone*. As we were going along, he called my attention to a round tower standing on an abrupt and naked height; this he said was built by Oliver Cromwell; he also pointed out Plymouth Citadel, from which, just then, the sound of trumpets was faintly wafted. Besides these, I noticed the new fortifications and a considerable number of circular batteries which were being constructed at intervals, some level with the water, and some on the sandy hills which command the Sound. The national pride of

my guide seemed especially flattered by the large number of foreign vessels—Russian, Swedish, Norwegian, and Dutch—which had anchored in the Sound during the last few days. The boat, the sail of which he had now set, glided like a bird over the surface of the gently-rippling waves. It only wanted, he said, somewhat of a brighter sky to recall to his eyes the Bay of Genoa, and yet the sun was that day doing its very best to lighten up the scene. The crest of every wave was luminous with a silvery light, in which the sparks of sunshine playfully flickered. It certainly was most favourable weather for descending to the bottom of the Sound. The land-line gracefully undulated on my right, opening to our full view the charming promenade of the Hoe, the bathing establishment, and the wooded heights of Mount Edgecumbe.

But we now approached the breakwater—that causeway of giants—by the side of which we soon discovered an old dismasted ship. This vessel is rough in appearance, and covered over with a kind of penthouse roof. In it live, as in a floating house, the operatives who are still working at the breakwater. They pass, alternately, one month on board ship and one month on shore. One of their little sources of profit consists in the sale of small fancy articles, which they say that they cut out with the blades of their pocket-knives from the rocks which they fetch up from the bottom of the sea. Very soon I heard the loud throbbing of ma-

chinery, snorting and puffing like so many marine monsters; it was the wheezy noise of the air-pumps which supply the bells when buried under water. I was, in fact, at the end of my journey; and there, according to the expression of my boatman, I was about to pay a visit to the conger-eels of the Sound.

Unfortunately, several obstacles stood in my way which I had not foreseen. The superintendent of the works did not consider that he was authorised in taking on himself so great a responsibility. None of them had ever heard of an "amateur" wishing to go down in one of these machines—a thing which requires a natural constitution proof against certain physical accidents. He only recollected but one or two cases where *savants* had attempted these submarine voyages, and then they had suffered much from a rush of blood to the head. One of them had even become deaf for some days afterwards. Another argument he used was still more convincing. He said that a descent of this kind cost the company about £12; it was necessary to interrupt the work, and to divert the air-pumps from the practical use for which they were intended. The only concession I could obtain from the complaisance of the *employés*—and this was considered a considerable favour—was to be present at, and inspect, the whole course of proceeding. I should thus, they added, see many details of action which I should have been unable to watch if I had myself descended in the diving-bell.

The workmen had been under the water for nearly five hours, and, if I waited until noon, I should see them come up. The portion of water under which they were buried was ruffled on the surface by a slight bubbling. This movement of the water, which is accompanied by a faint murmur, is produced by the surplus air shut up inside the bell, which from time to time escapes through the ever-gaping mouth. The moment was now arrived to relieve the men down below from their subaqueous duties.

The superintendent directed my attention to a massive scaffolding which was raised pretty high above our heads, and was supported on each side by two enormous wooden piles, the lower extremity of which went down into the sea. The transverse stage, which was on the top of the wood-work, was traversed along its whole length by a small geared runner—a sort of movable crane—to which hung iron chains. These chains, firmly fastened to hooks on the bell, serve to move it up or down. The signal had been given to "pull up." This order was immediately followed by a movement of the machinery, but the effect was far from being immediate. From a certain heaving of the water, and from the noise of the chains coiling in, it was easy to perceive that something particular was going on; but as yet the agitated surface betrayed no indication of any visible form. At last I distinguished something in the clear-obscure of the waves, which was not long before it appeared in full view; and, in fact, the bell itself began

to raise its convex head gradually above the troubled water. It gently emerged, and, before leaving the liquid element, seemed to imprint with its wide lips a kiss on the surface of the waves. The divers themselves sometimes talk of the amours of the diving-bell and the ocean. It rose with a kind of quiet solidity, and, when it had reached about three feet above the surface, it rested in the air, motionless and dripping.

I then noticed a small boat, managed by a sailor rowing it, which glided under the mouth of the bell, and from this hollow I saw emerge a pair of large loose boots reaching above the knees, which being followed by another pair of large boots, convinced me that two men were jumping down into the skiff. The boat itself, in fact, at once got clear of the dome, under which it had been half hidden, and I saw it come back to the vessel with two workmen on board, wet up to the waist, and covered with mud. They had just finished making their half-day under the water, and appeared to be fatigued. Their swarthy complexions were tinged on the cheeks and forehead with a bright sanguine hue. The position of the bell was not at all altered; it was as if they wished to give it an opportunity to dry itself and breathe a little fresh air. It was the dinner-hour for the men employed at the works. I had just been a spectator of the process of raising the bell to the surface; I now had to see it let down again into the bottom of the sea.

The same little boat which brought the two workmen

to the great floating house took them back again, after an hour's rest, to the vicinity of the diving-bell, which, hung just over the water, looked very much like an immense iron box open at the bottom.* The procedure in making ready for the descent has really something rather imposing about it, and, to an excited imagination, might very well suggest the preparations for the execution of a sentence of death. Nothing is wanting for the purpose: the scaffold, the secret cell, and the gulf of the menacing waves are all there. The divers, thank goodness! do not in the least anticipate such a fate, but, on the contrary, seem proud to walk safely over the bottom of the sea, where so many others have found their grave. Be all this as it may, the boat soon places itself underneath the bell, raised as it is three or four feet above the surface. The two workmen climb one after the other up into the inside, helped by an iron ring hung to the arched roof, which can easily be laid hold of by the hands. They take their places on two wooden benches fixed at a certain height in the hollow of the bell. Sometimes four, or even six, workmen have to find seats in this curious vehicle. When all this is done, the boat goes away, and in another moment the voice of the foreman gives the order to "lower away."

* The form varies very much according to the date of construction. At first all these machines were made in a conical form, and to this circumstance no doubt they owe their name of *bell*. Latterly the shape of a parallelopiped has been preferred.

Then the bell, as if animated by a downward and almost imperceptible movement, begins to descend towards the sea. Gradually the waves commence to wash round the lower rim of the machine as it goes down. It is essential that the four corners of this more or less square-shaped mass should touch the surface of the waves simultaneously and all on a level, for if it were otherwise, the water would find its way into the interior of the diving-bell. It is therefore highly necessary that the descent should be gentle and gradual, under penalty of causing immediate death. The bell had now, however, entered the surface of the waves, into which it sank by its own weight: being constructed of cast-iron, it was, of course, pretty heavy, although filled with air in order to exclude the water. The iron cap remained in sight for some little time above the waves, and then gradually disappeared. As the diving-bell was sinking, I could in some measure follow it with my mind's eye to the bottom of the sea, thanks to the explanations given me by the divers who remained on board.

How can these men breathe under the water? This naturally seems the first question to ask. In the centre of the roof of the diving-bell there is an orifice through which the provision of air is furnished. The vivifying element is supplied through a leathern pipe, the end of which is attached to an air-pump, which four men keep in movement. This pump works on the scaffolding

which hangs over the sea, and the leathern pipe, which is drawn out as required, resembles a *boa-constrictor* unwinding its coils. The valve, placed inside the bell, being one of the most essential portions of the machine, is carefully protected against any chance of accident. The superintendent assured me that the divers never wanted for air any more than for light. A dozen convex lenses, eight or nine inches in diameter, and firmly set in copper frames, receive the rays of the sun spread through the water. In some cases the *bull's-eyes* are protected externally by iron lattice-work against the blows which they might suffer from the rocks or other solid matters which are occasionally met with in the sea. The light which is thus shed into the interior of the bell varies, however, very considerably in colour and intensity, according to the state of the ocean and the depth to which they have sunk. In places where the water is troubled by sand, the diver often passes through a kind of twilight or submarine fog, which compels him to light his lamp. More often, on the contrary, the light is sufficiently strong to enable one to read a newspaper printed in small type. A story even is told of a lady who wrote a letter in the diving-bell, and dated it thus: "16th June, 18—. At the bottom of the sea." Her courage obtained for her among the divers the *sobriquet* of the Diving-*Belle*.

I also wished to make my mind easy as to the lot of the poor workmen whom I had seen descending in the

bell. The foreman assured me that they enjoyed every comfort in it. Have they not seats to rest themselves on, a wooden ledge on which to place their feet, an assortment of tools and necessary utensils suspended on a cord or hooked on to the walls of their hut, which is nearly as well furnished as that of Robinson Crusoe? From all this explanation I was bound to conclude, unless the foreman was mixing up a little irony in what he told me, that the divers were quite "at home" in the bell. The fact is, that really they pass in it a great part of their existence. Almost all of them suffer a good deal at first from a violent pain, which they themselves define as "a toothache gone into the ears," and they have a humming in the head, "as if some one had let fly a swarm of bees there;" but these troublesome symptoms disappear after the second or third descent. Their confidence in this dry chamber, almost isolated in the midst of the turmoil of the ocean, approaches sometimes to temerity. In 1820, Dr. Colladon, of Geneva, who had gone down in a diving-bell on the coast of Ireland, bethought himself that, at the depth at which he then was, a stone, or any other trifling cause obstructing the action of the air-valve, would be sufficient to enable the water to invade the bell. He confided this not very reassuring reflection to one of the divers who was with him. The latter, smiling, answered him by merely pointing out with his finger one of the glazed loopholes which were over their heads.

The doctor examined it attentively, and ascertained, in fact, that the glass was cracked sufficiently to allow bubbles of air to escape pretty freely. This was a very different and more serious cause of uneasiness than the rather improbable contingency of an obstruction of the air-valve. The diver was well aware of the cracked glass, and cared nothing about it.

The superintendent of the works now informed me that the bell was about touching the bottom of the sea. The divers were now separated from the rest of the world by the great ocean rolling over their heads; but still, by means of signals, they could communicate with the surface and their fellow-men. On these occasions they generally make use of a hammer hung by a cord to the dome of the bell, and this hammer plays an important part in the mysterious language of these submarine messages. No noise coming from the surface of the water can reach the ears of the divers; but, on the contrary, sounds ascending from the diving-bell are distinctly heard by those whose duty it is to listen for them in the open air. A particular sense is attached to the number of blows struck by the hammer on the resounding sides of the bell. Thus a single blow means "more air," or "pump faster;" two blows signify "hold hard;" three, "hoist away;" four, "lower down," &c. It is easy to see that something of a system has ruled in the formation of this telegraphic language, and that the orders which they are com-

pelled to give the most frequently are transmitted by the smallest number of blows.* To any one who is not accustomed to it, these concussions given to a rampart frail enough against so powerful an enemy as the sea, have something alarming about them; but the divers exhibit no anxiety at anything so trifling: the nerves of these vigorous men show no signs of tremor even in their trembling retreat.

They also avail themselves of other means of making signals; for instance, by the help of small buoys which they send up to the surface of the water. On some occasions they even exchange messages by means of a cord, one end of which is fastened inside the bell, and the other to the vessel up above. The workmen down below write what they wish, either with pen and ink on a morsel of paper, or with chalk on a piece of plank, and send this communication up to the surface. Their orders are immediately executed, or, in cases where this cannot be done, they are informed that the matter is not practicable. This correspondence occasionally even assumes somewhat of a sportive tone:—"Our compliments to our friends up above water," such was the text of one of these messages, to which a reply was sent in less than three minutes, "Health and happiness to the gentlemen inhabiting the kingdom of fishes."

* The same rule holds good in spoken idioms, in which matters of the first necessity are usually designated by a monosyllable, as *air*, *food*, *drink*, &c.

This system of signals exercises a happy influence, not only over the execution of the submarine works, but also over the minds of the divers themselves. Buried as they are in the silence of the deep waters, it forms, for them, the sole connecting link between the bosom of the abyss and the living world above them.

"They are just beginning to work," was soon remarked to me by the superintendent, who followed, even under the waves, every movement of his labourers. The nature of their operations varies, of course, very much according to the undertaking in which they are engaged. The two divers who had just gone down had for their task to clear away round the adjacent portion of the foundation of the breakwater. As soon as they reach the bottom, they jump off their seat, and armed with a pickaxe, begin to dig into the moist sand in order to get out the stones. It often happens that the movement of the tides, or some other cause, disturbs the water round the rocky base of the breakwater. The workmen have then much trouble in seeing clearly, and complain that "the water is muddy." Generally, however, the water is so transparent that even a cloud passing across the sky is visible at the bottom of the sea. The workmen also can labour with nearly as much ease and quite as much energy as if they were on land. The movements they themselves make, in conjunction with the circumstances which

surround them, occasionally cause something like a thick mist to rise before their eyes, hiding from them the nearest objects; they get quit of it by calling for an "air-bath." The air-pump redoubles its pace in working, and sends down to them through the pipe an extra current of air, which soon blows away the mist.

I was very soon enabled to judge for myself as to their industry: sacks which they had filled with muddy sand, and buckets laden with stones, came up to the surface every moment, drawn up by cords. One might have fancied it to be the mouth of a mine, to which invisible arms were constantly sending up fragments of rock; but here the mine was the sea. The nature of their digging did not allow them to work very long together in the same place. The divers had already requested by signal to have their position shifted on the bed of the Sound. How would they manage to comply with their wish? As regards air and locomotion, the men shut up in the bell depend entirely on the apparatus working on the surface. The chief organ of movement is a sort of *traveller* on four wheels, running over two tramways, allowing it to come and go in every direction. Immediately on the signal being given from below, the bell was raised from the bottom of the sea like a heavy balloon. This operation was of course carried out by means of chains, and the diving-bell remained for a minute or two

motionless in mid-water, like the pendulum of a stopped clock. But the *traveller* begins to move, and as it also acts as a crane, the pulley on the surface and the bell under water shift their position at the same time. The divers call this "travelling." They can thus move from north to south, from east to west, backwards and forwards. As they are in motion, if they come upon a piece of rock which encumbers the bed of the Sound, they give the signal to stop, and the bell becomes stationary, and then descends again slowly towards the block of stones. If they have been carried on a little too far, and want to retrace their steps, they communicate afresh with the men working on the surface, and the obliging machinery soon brings them to the exact point desired.

The perfect mutual understanding which exists both as to everything which happens at the bottom of the sea, and as to what takes place in the region where one breathes freely, is the base of all these submarine operations. Thus it is that man has been enabled to open safe communication with an element, the doors of access to which seem to have been for ever closed by nature herself; thus it is that the deep-water-line is now no longer either a limit or an obstacle to engineering enterprise.

But who was the inventor of the diving-bell? Workmen are not very often *savants;* yet I found that they were pretty well acquainted with the history of this

discovery. According to their ideas, there is good reason for surprise that the plan was not earlier adopted, founded as it is upon so very simple a theory. If we plunge a drinking tumbler upside down into a basin of water, taking care that the mouth of it touches the water evenly, the air contained in the glass will drive the water away before it. The superintendent, who seemed to be an educated man, traced back the origin of the bell to Dr. Halley; the learned, however, pursue the history of this invention much further back, and find evidence of it in a much more distant age. In 1538 two Greeks are said to have descended in an apparatus to the bottom of the sea in the presence of Charles V. It is, however, certainly to Halley, the celebrated astronomer of Greenwich Observatory, that the honour is justly due of having invented a machine for diving, constructed according to the principles of science. His machine was made of wood, and covered with lead. The air that was vitiated by respiration escaped from the chamber through an air-cock, and the pure element was supplied by barrels which descended and ascended alternately on both sides of the bell, like buckets into a well. These barrels, lined with lead, each contained about thirty-six gallons of condensed air, and acted in some measure like two lateral *lungs* for the diving-bell, with which they were connected by leather tubes. As soon as one of these air-casks was empty, they let down another of them.

Halley himself relates that in 1721, by the aid of this engine, he was able to descend with four other persons into water nine or ten fathoms deep, and to remain there an hour and a half. Occasionally the water entered and threatened to invade the interior of the bell: under these circumstances he repulsed the enemy "by pouring three or four barrels of air on his head." On reaching the bottom, he opened the air-cock through which the fluid already breathed had to make its escape, and the impure air forced its way out with so much violence that the surface of the sea was quite stirred up and covered with foam.

The glory of having been the first to apply the diving-bell to the works of submarine architecture is due, however, to Smeaton, the great engineer, whose name awakens so many echoes on the shores of Plymouth Sound. He it was who raised the famous Eddystone Lighthouse on a solitary rock, fourteen or fifteen miles out at sea. In 1779 Smeaton had made use of the diving-bell to repair the piles of Hexham Bridge, in the north of England, the foundations of the bridge having been undermined by the violence of the current. He also introduced various alterations in the form and appliances of the apparatus. About 1788 he was the first to construct a diving-bell of cast-iron; but the peculiar characteristic of his machine was the application of the air-pump, which, as it were, breathed for the benefit of the divers, freeing them

from the necessity of personally looking after the supply of the vital fluid.

This improved diving-bell was afterwards employed by all the marine engineers. In 1813 it played an important part in the works which have so altered the port of Ramsgate. The celebrated Rennie, who directed this gigantic enterprise, made constant use of the diving-bell in fixing the foundations of the Eastern Jetty, and in protecting the latter in certain parts against the attacks of the sea by a shield of solid masonry. This same machine has also powerfully contributed to developing the course of navigation between Glasgow and Greenock in Scotland, for by its aid they have been able to clear the bed of the river Clyde, and to remove the pieces of rock which they could not have reached or got out by any other means. At the present time even the bell is in full activity on the southern coast of England, where, in the tempestuous waters of the Channel, it is assisting in laying the foundations of a breakwater which may be compared to an arm of stone, and extends already more than half a mile between the town of Dover and the coast of France. The work, it is true, advances but slowly, hindered as it is by a thousand obstacles, among which must be reckoned the milky colour of the deeper waters, which, rolling over a bed of chalk, obscure the sight of the divers; but nevertheless, what a herculean undertaking it is!

But what need had I for seeking all these distant proofs of the utility of this invention, when almost everything round me proclaimed its services? At Plymouth the diving-bell has aided in clearing out the various entrances to the port, in bringing up lost anchors from the bottom of the sea, in laying the foundations of amphibious edifices, half built on the land, and half in the water. One of these buildings is the Royal William Victualling House, a vast store-house for the English navy: close to this it was necessary to construct a sea-wall, so as to allow the largest ships to load and unload goods on the granite-paved quays. In all these architectural works recourse was had to the diving-bell. The stones which have to be built in together at the bottom of the sea are cut out, prepared, and numbered beforehand, while they are on the bank above. They then let them down by means of a capstan into depths of thirty to sixty feet of water, where they are received by the artisans working under the bell, who fix them in their places, and actually get through as much work in this way as masons who are building in the open air. Thus the skill of man rears and consolidates in the very bosom of the ocean the ramparts that are intended to stem its fury.

The diving-bell has many times rendered service to engineers by putting them in a position to understand the nature of certain damage going on, which too often

threatens submarine works with complete destruction. When Brunel was in the course of making his famous road *under* the Thames, and the current of the river had broken through the arched roof of the tunnel, he went down in a diving-bell to see for himself the extent of the disaster. The machine had sunk under the water to a depth of nearly thirty feet, and reached the gaping opening which had been hollowed out in the masonry. This hole was, however, too narrow to allow the bell to enter. It was, therefore, necessary, either to give up the pursuit of his observations, or have recourse to some other means for reaching the scene of operations, which was about eight or ten feet below him. Under these circumstances, there was no hesitation about Brunel: taking hold of the end of a rope, he plunged into the breach, and remained there, under water, for about two minutes. His companions began to be alarmed, and pulling the rope, gave him the signal to come up again. He, however, intently occupied in his important examination, had let go the rope, and had but just time to catch hold of it again at the very moment that this, his only means of safety, was being pulled away from him. On his return to the interior of the bell, he was much astonished at the time he had passed in the water, which time much exceeded the average amount of man's natural powers.

It was quite worth while to try and discover the cause of this peculiarity. The fact could not be passed

over, that the atmosphere of the cone-shaped bell, being condensed by a column of water thirty feet in height, contained nearly twice the quantity of air that could be enclosed in any other vessel of the same volume. The diver's lungs, acting as air-sponges, were of course saturated with this condensed vital element at the moment when he left the machine: would it not, therefore, take more time than in ordinary circumstances to exhaust this double provision of breath? In another point of view, therefore, the diving-bell might be appealed to to throw some new light on the physiology of one of the principal functions of animal life. At least, a fact like the above seems to point to this.

Among all the undertakings which are carried on in the bed of the sea and the bottoms of rivers, one of those which require the most boldness in execution, and for which the diving-bell is often used, is certainly the destruction of submarine rocks. Plymouth is a town which is peculiarly favourable to great works of architecture, and I believe there is hardly a place in the world where a more inveterate warfare is waged against stone generally. I recollect seeing a cliff of rough limestone facing the sea, which, undermined at its base, and split into deep furrows, presented the appearance of a stone-quarry in full work. This shattered rock is crowned by a group of poor cottages, inhabited by the quarry-men and their families; the huts seem to persevere in still keeping upright on their

tottering foundations. Every now and then mines were exploding, and the blasting of the gunpowder tore in pieces the sides of the shattered mass; splinters of rock flew up as high even as the cottages above, and actually broke the windows. But they do not take much notice of these accidents, for these cottages offer them so many advantages. The tenants do not pay more than eighteenpence a week rent; they get plenty of pure and excellent water, and the sea-view is so fine! It is curious to see these workmen thus day by day sapping the foundations of their dwellings, from which, nevertheless, they so much dread to be expelled.

Not satisfied with attacking the rock on the surface of the soil only, they follow it even down into the sea. For this it is of course necessary to employ divers. The diving-bell goes down laden with three men, one of whom holds in his hand the boring-tool intended to perforate the rock, and the other two are armed with hammers. When the first workman has bored a hole in the rock to the required depth, he introduces into the hole a tin case filled with gunpowder, about a foot long and two inches in diameter. On the end of this powder-case or cartridge is soldered a tube, likewise made of tin, and fitted at the extremity with a copper screw. The bell slowly ascends, and as it goes up, the workman keeps on adding other lengths of tubing, which he screws one on the top of another, until the

whole reaches about two feet above the surface of the water.

The man who is appointed to fire the charge keeps close by in a boat, in which he has a small heater full of little bits of red-hot iron. He comes up to the projecting portion of the tube, and taking up with a pair of tongs a morsel of the glowing metal, he drops it down inside the tin pipe. This, of course, sets fire to the gunpowder at the bottom of the tube, and immediately blows up the rock. The portion of the tube next the cartridge is generally broken, but the remainder (which is fished up by means of a cord which the *lighter* takes care to fasten on to it) can be used on another occasion. At the moment of the explosion, those in the boat feel little or no shock, but the bubbling water rushes up to the surface with some violence. Any persons, on the contrary, who are on land close by, or on any points of rock which have any communication at the base with the mass which is blown up, feel a sharp convulsion, like the shock of an earthquake. For operations of this sort to be conducted with complete safety, it is necessary that the water should be of a certain depth—twelve feet at least; but this submarine blasting is usually done at much more considerable depths.*

* Most large operations of this kind are now conducted by means of a galvanic battery above the water, communicating its igniting spark through a conducting wire to the charge of gunpowder below.

This ingenious system of sapping and mining is often made available to free certain channels from rocks and reefs which seriously impede safe navigation. In the Menai Straits, between Holyhead and the Isle of Anglesea, two rocks until lately reared their threatening heads, one of which was known by the name of the "Cow," and the other the "Calf." These masses rising up above the waves were a constant source of peril to ships. In 1863, Mr. W. B. Hicks, of Falmouth, accompanied by some other divers, made it his business to blow up these obstacles. The operations are doubtless long since completed, and the two rocks have disappeared from the surface of the sea; a few years more, and the very name and recollection of them will have faded from the memory of navigators.

The diving-bell is the very counterpart of the balloon. Whilst aëronauts ascend to explore the expanse of heaven, the diver buries himself in another liquid atmosphere, also having its special laws, its currents, its different climates, its concentric *strata* pervaded by various degrees of temperature. Has the invention of the diving-bell—this balloon of the sea—been of any real service to science? Up to the present time the diving-bell, I am pretty well convinced, has given rise to but very few exact observations. Certainly the state of the pulse has been ascertained in persons going down in this apparatus; but the comparative temperature of the water at the surface and at different depths,

that of the air in the interior of the chamber, and a thousand other remarks which might be made as to the bed of the sea, have been but very vaguely dealt with. There seems a something wanting here which it may be well to point out to English *savants*. The diving-bell is still waiting for its Glaisher, the intrepid aëronaut who, by his scientifically-practical ascents and his delicately-adjusted instruments, seeks to snatch their secrets from the glacial heights of our atmosphere.

The diving-bell, in its subaqueous descents, seems to be exposed to many a danger, and yet, thank God, accidents are very rare. There is not a single diver who does not know but too well that if the chain were to break by which they are suspended in the water, all would be over. No hope could be entertained of raising the bell in time to save them: it is much too heavy: the dome of the bell would be as the covering-slab of their grave. This misfortune is not the only one that they have to dread. It may happen that a movement of the sea, or some bad management, may disturb the equilibrium of the bell, and even then the divers run a great risk of being drowned. At Blackwall, near London, one of these machines, having three men in it, began to fill with water. Fortunately, one of the divers, who was endowed with great presence of mind, plunged in under the opening of the bell, came up to the surface to give the alarm, and was thus the

means of saving his companions. At Plymouth, where the diving-bell has been in use in all parts of the Sound, and at all depths, for more than fourteen years without intermission, there has been scarcely a serious accident to deplore.*

The divers whom I saw round me by the Plymouth Breakwater were a race of amphibious masons, working half their time under water, and the other half on the great causeway which they have themselves helped to construct. Considering the hardships and dangers which they brave, one might readily fancy that they were tempted into the deep by the allurement of some considerable gain. This is, however, by no means the case. Their wages are not higher than the scale for ordinary workmen. They are paid sometimes by the piece, sometimes by the day; but in any case they very rarely gain more than 20*s.* to 25*s.* a week. And then they have their dead season: when the swell is very violent they cannot go down in the bell. Some-

* With an idea of doing away with the formidable hazard of a conflict with the most treacherous of elements, a new machine was invented some years back in England, called the *Nautilus*. I myself saw it in 1857, in the Victoria Docks, London. The peculiar feature of this invention was what the English call *self-government*. The movements of this air-chamber were entirely dependent on the will of those who were in it, in place of relying, as in the old diving-bells, on extraneous aid. If the air-tube, which communicated up above with a reservoir of the necessary element, happened to break, the men were able, by means of air compressed in the machine, to drive back a portion of the water and rise up again to the surface.

times it happens that the surface is calm, but the deeper part of the water is agitated by what the English call the *ground-swell*, a kind of vibration of the sea which considerably hinders their operations.

In the summer time they pretty generally remain under water from seven o'clock in the morning until noon, and from one until six in the evening. Their health does not appear to be much affected by this long confinement in the atmosphere of the bell. They assured me that the time appeared to pass quickly at the bottom of the sea, and, at all events, they got a formidable appetite there. As they constantly work with their feet and legs plunged into the water or wet sand, some of them acquire certain infirmities. For hygienic reasons, most of them think it best to drink a glass of strong liquor on returning to the surface of the water. The temperature at the bottom of the sea is pretty nearly the same during all the seasons of the year; but in winter, when they come up to the top all in a glow with their hard work, they find the outer air extremely cold. Habit has long since hardened them against the headaches which attack novices only, as also the singing in the ears. None of them appear to have lost any portion of their acuteness of hearing; indeed, they pretend that the compressed air in the bell is an excellent remedy for deafness. The workmen also quote an instance of a consumptive person who was entirely cured by using the diving-bell.

Whilst they are living on board their vessel, and, indeed, on shore, their habits do not materially differ from those of sailors generally.

Although this pursuit is not a very ancient one, still it has its legends. One of them is, as the workmen themselves call it, a nursery tale which they tell in the evenings to their children. *Jack* (for this is the name given to a diver who lived "once upon a time") had been busy for some weeks in gathering up the relics of a shipwreck, when one day he saw appear at one of the windows of the bell the pale face of a woman, with long hair intertwined with seaweed. He had often heard tell of the beauty of mermaids, who are, as every one knows, lovelier than the most lovely of women; but Jack never believed that any creature so perfect as this could have existed. With a voice softer than the murmuring of the waves under a gentle breeze, she said to him, "I am one of the spirits of the sea. On account of your kind disposition, I have marked you out among the rest of your companions, and I will protect you, but on one condition only, which is, that you shall be sure and recognise me under any and every shape into which I may be pleased to change myself." The vision disappeared, and Jack remained very much surprised, but with a strong feeling of joy in his heart's core.

From this moment everything succeeded with him. Where other divers gained one crown he gained three.

Recollecting what the siren had told him, he took the utmost care to treat with kindness every inhabitant of the sea. When the bell went down into the water like a hollow column, he used to see distinctly a little below his feet the fish and other marine creatures; but he took pains never to frighten them away. More than once, when the bell was ascending to the surface, and the warm vapour covered with a mist the loopholes of his prison, he looked, but looked in vain, for the vision of the *Lady of the Sea*, for he longed very much to see her again. But she never showed herself to him any more.

Nevertheless, everything went on prospering with him. His wife and children began to believe that it was owing to the dried scalskin he wore under his clothes, and that this brought him luck. He had not dared, in fact, to mention to them about this sea green-eyed mistress of his who watched so carefully over him. One day, however, he worked several hours in succession without finding anything of value. The ground-swell obscured the light in the interior of the bell, and prevented him from discerning the objects around him. As he was returning home in rather an ill-humour, he came upon a frightful polypus that the ebbing tide had left lying on the sand. Jack, forgetting his habits of kindness to all the denizens of the sea, crushed it with his foot, and went home to eat his supper. The next day, soon after he had reached the bottom of the sea,

what was his terror to see through the glass window of the bell, not the attractive face of the mermaid, but a monstrous shark! The creature approached almost close to the face of the diver, and said to him, "You have disobeyed me, and must therefore die." In fact, some days afterwards an accident happened to the machine, and Jack was drowned.

Although the diving-bell still continues to render important service, it has been deposed within the last few years by another invention. The bell is now-a-days employed only in fixed and stationary operations. For those works, on the contrary, in which movement and freedom of action is required from the labourers, the *diving-apparatus* is much preferred. I ascertained that at Whitstable, at the mouth of the Thames, there existed quite a colony of divers who worked after this new method. As soon, therefore, as I had taken leave of the workmen at Plymouth Breakwater, I made up my mind to visit, at the first opportunity I could find, a totally different field of submarine operations.

CHAPTER XI.

WHITSTABLE AND ITS OYSTERS—JOHN GANN, THE DIVER—DOLLAR ROW—A DIVER'S STOREHOUSE AND HIS DIVING APPARATUS—ORIGIN AND HISTORY OF THIS APPLIANCE—M. SIEBE—THE DIVERS AT DOVER—THE TOILET NECESSARY FOR PAYING A VISIT TO THE SEA—THE HELMET—THE AIR-PUMPS—SENSATIONS FELT IN GOING DOWN UNDER WATER—USE OF THE DIVING APPARATUS—BUILDING OF THE NEW BRIDGES IN LONDON—THE "AGAMEMNON"—HOW PUMPS ARE REPAIRED AT THE BOTTOM OF DEEP WELLS—THE "ROYAL GEORGE"—WHAT DIVERS FIND IN SHIPWRECKED VESSELS—THE "ROYAL CHARTER"—DROWNED PEOPLE—SUBMARINE NAVIGATION—WHAT IS TO BE SEEN AT THE BOTTOM OF THE SEA—GEOGRAPHY OF THE SUBAQUEOUS REGIONS—M. EUBER AND THE SHARK—DEPTH OF THE SEA—THE FIELDS OF ETERNAL NIGHT AND THEIR INHABITANTS—IMMOBILITY OF SUBMARINE PHENOMENA—THIS IMMOBILITY ONLY APPARENT—PROBLEMS TO BE RESOLVED BY SCIENCE BY THE AID OF DIVERS.

In the course of last year (1865) I went from Canterbury to Whitstable by a small branch railway, having only a single line of rails, over which a rickety, broken-winded old locomotive went limping along. The village of Whitstable itself has nothing about it which is specially curious. The great event there, the day I visited it, seemed to be a barrel-organ, accompanied by a drum, and a monkey. Stretching up-stream from this brick-built village stands a hamlet of wooden

houses lying by the Thames. It bears the same name as the other, but it has far more character about it. There, on the strand, stand rows of cabins built of planks, and daubed over with a coat of pitch. These black-looking huts are occupied, some of them as storehouses for taking care of the sails and the rigging, some as counting-houses, and some by the fishermen and their families. Traversing these streets, or rather alleys, which cross and recross one another, we find ourselves on the edge of the water. It is difficult to imagine anything more beautiful than the estuary of the Thames is just here. Being at this point neither river nor sea, the Thames here unites the charms of the one with the majesty of the other. The line of the river-bank opposite seems indistinctly sketched out on the horizon like a summer cloud. One point of land, however, the extremity of the Isle of Sheppy, stands out decisively into the water, and appears to divide it. The tide flows up with a soft, quiet, though certain motion, filling gradually the sand-bedded basin of the Thames' mouth, bounded by its banks, now high and now low, in picturesque diversity. Whitstable might well become a sea-bathing town—a *watering-place;* but it has, in fact, something better to do than to give itself up to pleasure and its votaries, for it is the head-quarters of the oyster fishery.

At five o'clock in the morning, the bellman, armed with his noisy weapon, goes round the streets and

wakens up the dredgers. The latter very soon make their way down to the strand, where they embark by threes in the smacks or fishing-boats. The oyster banks lie at about a mile from the shore, and are like so many nursery gardens, being well looked after, and marked out by buoys on the surface of the estuary. The spawn or *spat* of the young oysters, which is often brought from great distances, having been purchased at fabulous prices, is laid down in these shallow waters, where the dainty molluscs can grow and fatten. On Tuesdays, Thursdays, and Saturdays the fishermen are busy in, as it were, cultivating these banks, which they call dredging for planting. Their task consists in examining carefully the young oysters, and freeing them from the enemies which might injure them. On the other three days in the week they are engaged in getting up the full-grown oysters from the bottom of the water in their nets or dredging-machines: these full-grown oysters are those which are three or four years old, and are fit at once to be sent to Billingsgate Market. From the agents at the latter place they also receive information by telegraph, telling them the number of bushels of these shell-fish which would be likely to sell at a good price each day, and this demand is divided equally among all the members of the fraternity, for they have in fact for some time past formed themselves into a complete association. A *water-court*, or dredgers' parliament, held once every year, reforms

their rules and regulations where there is any need, confers duties on certain persons, and nominates a jury of twelve men. In this parliament every dredger has the right to vote by means of the ballot. It was the month of August when I visited the little town, and the oyster season was just beginning to open. This event in England always gives rise to a singular custom: the children build up at the corners of the streets little grottoes made of oyster-shells, inside which, at nightfall, a candle is placed. As it is an English principle that every labourer deserves his pay, the young architects demand clamorously from the passers-by some recompense for their trouble. You may see them running from one to the other, presenting an oyster-shell for their money-dish, and loudly repeating the invariable formula, "Please to remember the grotto." If the importuned pedestrian hesitates about paying the voluntary tax, they endeavour to overcome his unwillingness by the irresistible argument that it is "only once a year."

But I had not come to Whitstable for oysters, although they offer them there to every stranger, and sell them at least double as dearly as they do in London, under the pretence that they are the local produce of the sea. I had been told to ask for John Gann, the diver. Every one in the place seemed to know him, and I had but little trouble in finding his cottage; but, as he was not at home, I had time, as I was seeking

him all over the place, to examine the outskirts of this little town, which stretched away over a kind of down. In a garden belonging to one of the humblest of the cottages I noticed an object which attracted my curiosity. When looking at it from a distance, one might have fancied it a man fastened to an instrument of torture, the feet being stretched out by two stakes, and the arms extended crosswise on another piece of wood. I recollected that I had seen a punishment something like this in Chinese engravings; but, on coming closer, I found that this effigy of a man was nothing but a diving-dress, of course with the helmet attached, which was being dried in the sun.

But some one had at last found John Gann for me. A young girl, half hidden in a large bright-coloured handkerchief, which covered her head and shoulders like a monk's cowl, came to tell me that the diver was coming to meet me. He was a stout man, about fifty years of age, with a full, round, red face, every feature of which indicated good temper. He was dressed in a sailor's blue jacket, over which he displayed a handsome black cloth paletot. We went into a little tavern to have a chat, and when there John Gann, the diver, soon found out his error. Having heard that some one was asking for him, he had fancied that the business in question related to some vessel having been shipwrecked, the sunken treasures of which he was required to search for. I was compelled to confess that all the

ships I was possessed of were quite safe from the tempest. He subsequently understood the object of my inquiries, and seemed most anxious to assist me.

For some few years John Gann had not been in the habit of personally going down to the bottom of the sea, although in his youth he had been one of the first to make use of the diving apparatus. At the present time he acted as the chief of ten or twelve divers, whose labours he directs. After some of the violent tempests which so often desolate the English coasts during the stormy season, he often receives orders by telegram to send men to the scene of one of these shipwrecks. They are brave and vigorous fellows, whom at first sight I should not have distinguished from other sailors. They generally commence their trade at the age of twenty; but it is quite necessary that their constitutions should be strong and healthy: some of them continue in their vocation up to sixty years of age, and even later.* The immoderate use of spirituous liquors would be fatal to them; they are consequently generally remarkable for their sober and regular habits.

These divers generally work either by the week or for a percentage on the value recovered, according to

* I knew a diver who was close upon seventy years of age, who, until quite lately, passed more than a quarter of his life under water. "You see," said he, smiling, "that the employment is not a very fatal one."

the nature of the sunken cargo. In the former case they receive £5 a week for the diver and the man that accompanies him; in the latter, they have a share fixed beforehand on all that they find. Under calm water they will remain three or four hours in succession, and will then come up to the surface for an hour, in order to recruit their strength. Some of these salvage undertakings are very productive. John Gann and his divers recovered the value of £100,000 from the wreck of the *Lady Charlotte*, a ship which had gone down to the bottom of the sea. The Whitstable divers were also at work for some time on the coast of Ireland, in a place where a Spanish vessel had sunk, in which they discovered a large number of dollars. These dollars had been originally enclosed in a barrel, but the wood had perished at the bottom of the sea, and the hoops of the barrel were displaced; nothing was left but the pieces of coin, and these, gathered in a lump, still retained the form of the cask. With this money a row of houses has been built at Whitstable, which I saw; they still bear the name of Dollar Row.

John Gann was good enough to take me to his store-house, in order to show me all his diving-apparatus. It was one of the black-painted cabins which I had before noticed on the strand. Having climbed up on a cart which temporarily formed the outside staircase to the entrance-door, we found ourselves in a large room made of wood, and filled with appliances the use of

which was explained to me by Gann. I now saw more clearly the difference that exists between the diving-bell and the diving-apparatus. In using the former, the bell-diver is confined by a prison of cast-iron and glass; the diver, on the contrary, who is fitted with the diving-dress, moves about just as he pleases at the bottom of the sea.

The history of this latter invention is rather obscure; but it appears certain that about the year 1721, one John Lethbridge constructed an apparatus somewhat resembling the diving-dress of the present day; it was like a cask, with two holes for the arms, and a glass loophole through which to see all that went on in the water. The diver, in order to work, had to lie down upon his breast, and he was compelled to be often raised to the surface to breathe the fresh air.* This clumsy arrangement may, however, have been the germ of the modern discovery. In this apparatus, as in many others both before and since, no means were provided for renewing the supply of air to breathe. For more scientific arrangements we must hasten to turn to rather later times. Even in the bell constructed by Halley there was an apparatus which allowed the diver to venture some distance from his prison, and to remain for a short time at the bottom of the ocean. This apparatus consisted of a kind of leaden cap with

* Any that are curious in this matter may find a full account of this machine in the *Gentleman's Magazine* for October, 1749.

glass eye-holes; it completely covered the head, and received air from the interior of the bell by means of a flexible tube. It is easy in this to recognise the link between the two systems.[5] If the two branches into which Halley's plan is divided are separated, one of them would soon develop into a distinct invention. In fact, in 1798, one Kleingart, of Breslau, contrived an apparatus which, instead of being grafted, as it were, upon the diving-bell, allowed the diver free liberty of movement. The latter carried on his back an air-vessel—for instance, a bag of goat-skin, inflated with wind, like bottled Æolus—which communicated with the mask of the diver by means of a tube. This apparatus, however, was altogether too heavy to render any efficient service. We must turn to the nineteenth century to meet with the plan which has at length achieved for itself a high rank among scientific expedients. In 1829, M. Siebe, a submarine engineer, invented, in conjunction with Charles and John Deans, the first diving-dress equipment in which the diver buried under the water received a continuous supply of air from the surface by means of an air-pump and tube. Gann was the purchaser of the second of these instruments which had been constructed. This invention has been variously improved from time to time. Since I was at Whitstable, I saw at M. Siebe's, at 5, Denmark Street, London, a very curious series of various appliances illustrating the progress of this art,

from the first diver's helmet which was ever made, down to the present apparatus, which had just obtained a prize-medal at the Dublin Exposition. It also becomes my duty to express my gratitude to this excellent engineer for the notes and information which he was good enough to place at my disposal.

All that I saw at Whitstable was, doubtless, very interesting; but, as I observed to John Gann, I should understand the nature of the diving-apparatus a great deal better if I could manage to see it in operation. I therefore begged him to let me know the place where his men were then at work. Some of them, he told me, had been for some days occupied in the sea off Dover. Having given a hearty shake to the hand which had so many times sought fortune at the bottom of the sea, I parted with the master-diver of Whitstable, and bent my way to the old white-cliffed town.

Thanks to the information given me by the coast-guardsmen, who, next to the London policemen, are perhaps the most civil and obliging men in England, I had but little trouble in finding out whereabouts the divers were. They were working a good way further up on the coast, in water which, though shallow, was rather perfidious, at a spot where a vessel had struck upon a sandbank. Having arranged to meet them in the evening at a little public-house which was frequented by sailors, I subsequently there explained to them the object of my visit, which seemed much to

surprise them. It was agreed that I should go off the next morning in a boat, and visit the vessel out at sea on which they were working. This vessel, firmly moored, was, as it were, the base of their operations. There it was that the divers took up their quarters before going down into the water, or when they came up again from the bottom of the sea. There also, on a kind of platform, stood the air-pumps and the men appointed to work them. These air-pumps appear on the outside to be nothing but mere boxes, in shape like a large travelling-trunk, but containing on the inside steel cylinders, and a complete system of ingenious mechanism. When it is wished to set this mechanism in motion, they fix outside the box a fly-wheel and two crank-handles, which are turned round by two workmen by manual power. Instantaneously a jet of air escapes with great force through a valve opened in the lower part of the pump-case.

Just at the time when I got out of my boat the divers were on board, and were taking their hour of rest. As I was bent on obtaining every information both as to the nature and use of their equipment, I asked if they would allow me to put on the diving-dress. This they consented to. A description of this apparel, every article of which forms part of a system, can hardly be considered extraneous in an account of modern submarine invention. The professional divers are clothed entirely in woollen material, and when they have to

descend into very deep water, they also protect some parts of their body with a basket-work enclosure covered with rough flannel. All these under-clothing arrangements are nothing more than precautionary sanitary measures. They soon brought me the actual diving-dress: it is a large grey garment, made of india-rubber, all in one piece, and of course waterproof. One has to get into it from above, as if into a sack, and it is finished off by a pair of trousers with feet, as well as two sleeves. The upper part of this garment was then closely fastened round my neck by a handkerchief, and round my wrists were placed india-rubber rings, so as to fasten down on the flesh the ends of the sleeves, already tight enough, as I thought. I had not much difficulty in understanding that this latter precaution was intended to prevent any water getting in. I was then shod with a heavy pair of shoes with leaden soles, each weighing ten pounds. Having put a woollen cap on my head, my shoulders were loaded with the metallic helmet-collar—a kind of pelerine of tin, polished like steel, with a copper edging. By means of holes bored in this edging, and screws which fitted into them with wonderful accuracy, the lower part of the collar is hermetically fixed on a leathern pad which runs round the top of the dress, encircling the chest and back.

I was thus encased, when a friendly hand placed on my head a helmet of spherical shape, with a large glass eye on each side, and one opening only, opposite the

mouth. It was through this I breathed, and certainly not over and above well. My position reminded me somewhat of the story of the "Iron Mask," especially when they riveted the helmet firmly on to the metallic collar of which I have just spoken. To add to my accoutrements, a belt was placed round my loins, to which was hung a dagger-knife, the formidable blade of which was enclosed in a copper sheath, the only means for defending it from contact with the water. The dagger-knife was intended to sever the gordian knots which I might meet with on my subaqueous journey, and no doubt also to give me means of defence against any marine monsters I might fall in with. All I now wanted was an axe in my hand, and then I should have resembled a real diver—as much, at least, as a caricature resembles a portrait. But no, I was in error. The divers called my attention to the fact that at present I was too light, and that as I was I should not be able to descend to the bottom of the sea. They therefore hung on, in front of my chest and behind my back, two pieces of lead weighing forty pounds each. Now, at all events, my toilet was complete. When I looked at the shadow which I threw on the deck of the vessel, I could hardly help laughing. What fabulous animal could it be into which I was metamorphosed?

But it was not my shadow only which astonished me. Whenever I tried to speak, my voice sounded hollow and dull in the cavity of the helmet. I asked

the divers whether, being already so far advanced on the road, I might not attempt to descend to the bottom of the Channel in good earnest. They stared at me with wondering eyes, in which I fancied I read a feeling of doubt and anxiety. "At all events," said one of them, "he can do as he likes."

This same diver undertook to give me the requisite instructions. He showed me the way to get rid of, by one movement of the hand, the two pieces of lead which were fastened on my breast and back; and assured me that, when this was done, I should immediately rise up to the surface. "I should not give this advice," he added, "to a diver by trade; for we consider it rather a disgrace to leave our lead weights at the bottom of the sea, having other means of calling for help in case of danger or accident. The diver is in communication with the surface," he continued, "both by the *air-pipe* and by a rope which we call the *life-line*. Both of these appliances speak a language of their own. But of all these signals there is only one which concerns you: if you wish to come up, you must give four pulls to the air-pipe, and that means *haul up;* it will not be long before your wish will be understood and complied with. The whole time that a diver remains under water, there are on board two reliable men, whom we call *attendants*, who watch over him just as a careful nurse does over a child walking with leading-strings. These three men may, in fact, be said to form but one,

and the whole science of diving is based on this system of perfect concurrence. The two attendants are forbidden by our rules to talk to each other, or even to any other person, during the whole time that they are performing their duties. Talking might divert their attention, and they need use the utmost vigilance to catch the sense of the slightest signal. They are, in fact, answerable for the life of the man at the bottom of the sea. Now then," he added, "you must consider if your heart misgives you, or if you think you can enjoy a short time all alone along with the waves. Oh! I had almost forgotten an important piece of advice. Sometimes it happens that the diver loses his way in the sea, and finds himself unable to regain the bottom of the ladder by which he went down. To guide us in a perplexity like this, we employ a cord rolled round the wrist, which unrolls as we walk along. If, from any special cause, this clue happens to fail us, the diver may insure his safety by making the signal of distress—*Haul up!*—and he is immediately taken out of his difficulty by being drawn up to the surface."

I assured the diver that all this latter advice might be very good, but that, as far as I myself was concerned, it was perfectly useless, for I had not the slightest desire to venture very far in a region which was so perfectly unknown to me. "Well, I half suspected as much," replied he, smiling.

The helmet which covered my face and head was

provided on the back part with two *hollow* metallic studs: one of these was protected against the intrusion of the water by a strong valve, and was intended to give vent to the air vitiated by breathing; the other, called the *pipe-holder*, was to be fixed to the air-tube. I had noticed, in fact, on the deck of the vessel, a long india-rubber pipe, coiled round and round like a slender serpent. One of the sailors took hold of the head, as it were, of this elongated reptile, and screwed it into the air-pump, whilst he inserted the other end—the tail, so to speak—in the pipe-holder or metallic stud on my helmet. I could then well understand how the whole theory of this art is based, as might be expected, on the physical constitution of man. The diving-apparatus only doubles and lengthens his respiratory organs; the air-pump is for him nothing but his *external* lungs, and the air-tube is only a floating wind-pipe. It was not long, however, before they closed up the only orifice by which I had any communication with the outer world, by screwing on, in front of my mouth, a third pane of glass, which was oval, and protected, like the two others, by a copper wire-work. We must not lose sight of the fact that there is nothing but a thickness of glass between the diver and the ocean—between life and death. If any external obstacle—some projecting point of iron—should chance to break this frail barrier, in a moment he would have to deal with all the waters of the deep.

Almost before they had finished fixing on this glass in front of my helmet the pumps began to work, and to supply me with air; but for this I should have been stifled, for the only part of my person which was now in contact with the atmosphere were my hands, and I could not effect much in the way of breathing through them. This function was now entirely dependent on the air-tube; but oh, if this tube happened to break! It was explained to me that even under these unlikely circumstances, a valve would close spontaneously to prevent the rushing in of the water, and that enough air would be left inside the diving-dress to enable me to live some instants, just time enough, in fact, for me to be rescued. This was at least some consolation. I could now neither speak nor hear, but I could still see very well—for had I not my three glass eyes? I was directed by signs to make my way to a ladder which went down into the sea from the side of the vessel, but the difficulty was for me to move. I seemed as if I was glued down to the deck by my leaden shoe-soles; my back and breast were loaded with weights, and besides, I felt as stiff and uncomfortable in my india-rubber garment as if I had been sewn up in the skin of some marine monster. However, I did my best, and at last reached the first round of the rope-ladder, which was stretched pretty tight by a considerable weight at the lower end, and passing round the side of the ship above the water, then disappeared.

The good-hearted sailors, however, did their best to help me, and guided all my movements; they taught me how to pass the air-tube under my left arm, and the signal-line, bound round my body, passed upwards over my right shoulder. The upper ends of the tube and line were held by two men, who were, in divers' phrase, my attendants. I do not reckon a third man who accompanied me to show me the way. The ladder seemed a very long one to me, although there were not more than eight or ten feet between the edge of the vessel and the level of the sea; but the terrible moment is that when one touches the surface of the waves: although the sea was that day as calm as a pond, I felt myself beat about and buoyed up by the natural movement of the waves rolling one over the other, in spite of the leaden weights attached to me. But it was much worse when my head went under the surface, and I saw the water dancing about round my helmet. Had I too great a supply of air in the apparatus, or had I too little? Really it would be difficult for me to say; the fact is, that I felt almost suffocated. At the same time, it seemed as if a tempest was roaring in my ears, and as if my temples were screwed up tight in a vice. In good truth I had the strongest desire to go up again immediately, but shame was more powerful than fear, so I slowly descended—too slowly for my liking—for this ladder down into the deep appeared as if it would never end,

and yet the water at this spot was not more than thirty or thirty-two feet deep. I could scarcely summon up presence of mind enough to observe the gradual deterioration of the light round me; it was a pale, doubtful twilight, which to me very much resembled the London atmosphere in a November fog. I fancied I saw living forms floating about here and there, without at all being able to say what they were. At last, after a few minutes, which seemed to me a whole century of trial and torment, I found my feet were resting on a surface which was something like solid. My reason for thus modifying my expression is that the bottom of the sea, when you are on it, does not appear to be a very satisfactory base: every moment one is buoyed up and half carried off the legs by the moving masses of water, and I was compelled to hold tight on to the ladder with my hands to prevent being tumbled over.

There was, however, one essential instrument which I was in need of: the divers, to enable them to walk firmly in the ocean, are in the habit of using a crow-bar, on which they lean as on a walking-stick, but I was quite encumbered enough already without this iron bar, which would have been no use to me. For I had not the slightest intention of walking about; I was much too dismayed at the impressive silence and gloomy solitude of the water, in which I seemed to myself lost. Here, however, the light was much

brighter than it appeared to be when I was half-way down, and the pains in my head left me as if by magic. Wishing to carry back with me a tangible proof of where I had been, and a *souvenir* of my excursion, I stooped down and picked up a pebble from the bottom of the sea. I was going to put it in the pocket of my dress, when I found out that I had no pocket, and that I must stick it under my girdle. This being done, I gave the signal to hoist me up to the surface.

I fancied I should experience quite a feeling of joy in getting back into my own element again. But I had first to get on to and to ascend the height of the ladder. When I at last got on board the vessel, they first took off my visor, and then the helmet and collar all in one piece, and lastly my diver's dress. The only thing I remarked was that it was much easier to get into this garment than to get out of it; the ends of the sleeves were so tightly stuck down upon the skin that it was necessary to use an instrument called the cuff-expander to stretch the stuff. My under-clothing was not the least wetted, and I am bound to acknowledge that the cloth of which the diving-dress is made well deserves the title of waterproof, which is given it by the inventors. The good-tempered sailors congratulated me on my return to life, and laughed heartily at my freak. As they said, I had only made a dive as a duck does down to the bottom of the sea, and, in truth, my

brief descent had not been much else; but still, had I not attained the end I had proposed to myself? I knew now, by experience, all the essential details of the art of diving, and, as the result, I could not help admiring the courage, and wondering at the acquired nature, of these men, who were not merely capable of remaining a few minutes under water, but were able to continue there for several hours, and to execute all kinds of difficult work.

The diving-apparatus is more adapted even than the diving-bell to certain operations of submarine architecture. It has been lately used for laying the foundations of piers, sea-walls, and breakwaters. The lower portion of the new bridge at Westminster, in London, was constructed by workmen provided with this apparatus.* During the time that the work was in progress it was curious to see these men going down a ladder through the monstrous scaffolding, and disappearing in the water with their helmets. Their first business was to get out of the water the remaining masonry of the old bridge. Every moment powerful cranes were bringing up to the surface enormous blocks of Portland stone, which had been disconnected and raised from the bottom of the water by the divers by means of levers. Then they had to lay the foundations of the new bridge.

* They adopted Mr. Heinke's diving-apparatus, which is distinguished by some peculiar features. A double valve fixed on the front of the collar enables the diver to go up or down at will.

They worked on at this both by day and night; but, after all, what was the difference? Even when the sun shone bright enough overhead, the water of the Thames was so thick and so charged with muddy matter, that the divers could scarcely see anything at a distance of eighteen inches or two feet from them. This twilight was sufficient to enable the engineers to inspect the state of the works, but the workmen fixed the blocks of granite almost entirely by the light of lamps. These operations were carried on during both summer and winter for four years and a half. The workmen, being well clad in woollen clothes, felt but little of the cold under their diving-dress, but their hands, which were exposed to contact with the water, were sometimes so benumbed that they could not feel it even if they struck them with the hammer, and did not know that they were wounded until they had returned to the surface of the water. This system of working by means of the diving-apparatus has been admitted to be much more economical and expeditious than the old plan with the bell.

The diving-apparatus is every day rendering considerable service to navigation. A man-of-war, the *Howe*, had lost her anchor and cable; a diver, equipped in M. Siebe's apparatus, went down to the bottom of the sea, and by means of a chain which he fixed on to this mass of iron, they were enabled to haul on board again both the anchor and cable. Is it not also very

frequently the case that the hull of a ship at sea experiences very serious injuries? By the aid of the diving-apparatus a man can now repair the damaged parts even under water. Thus it was that the *Great Eastern* was saved while returning from America, and was enabled to reach the port of Liverpool. At the time of the siege of Sebastopol, an English man-of-war, the *Agamemnon*, being under the fire of the forts, was struck by a shot below the water-line. Probably it would have been all over with the ship; but the carpenter, clad in his diver's equipment, went down to examine the extent of the disaster. He soon succeeded in closing up the wound, and came up again to announce that now all was right again. A certain number, therefore, of the sailors of the British fleet are now trained to the use of the diving-apparatus.

The repair of ships is not the only purpose of this kind in which the diving-apparatus has been successfully used. It also holds no mean rank in rectifying any disorganisation in mines. An accident happened a few years back at the Dearnley Colliery, near Rochdale. The pumps had given way, and the water had made an inroad into the lower part of the pit to a considerable height. When they thought that they had remedied the mischief, they found out that the machine worked with difficulty. There was evidently, as the English say, "a screw loose somewhere;" but the question was to find out where. In the meantime the

pumps entirely refused to raise the water to the surface. The engineer then formed the idea of introducing a diving-bell into the mouth of the shaft. A messenger was sent to Liverpool, where Ellis Javons then lived, a diver who had made himself famous by recovering some treasure from a shipwrecked vessel. He came to Dearnley with a comrade who was to assist him in his undertaking. Ellis Javons was not, however, a *bell-diver*, but was accustomed to use the diving-apparatus. He therefore descended into the mouth of the inundated mine, all equipped in his waterproof garment and helmet. In about half an hour he reappeared, carrying in his hand some broken springs. He had discovered the cause which had paralysed the action of the pumps. The water escaped by an opening in one of the pipes with such force that it had thrown him against the sides of the shaft. He went down a second time, and then a third time, armed with all the requisite implements for the job, and completely succeeded in stopping the improper flow of the water.

The diving-apparatus is also used in any operations required in deep wells. Mr. Tilley, a London engineer, employs a diver who, in case of need, can descend to a very great depth. A short time back this workman brought up the cylinders of a pump which he had been down into 80 feet of water to fetch up, and at 240 feet from the ground-level.

The principal object, however, of the diving-appa-

ratus is to assist the divers in recovering the riches engulfed by the sea. In 1844 a company of divers were employed to raise the remains of the *Royal George*, a man-of-war of 104 guns, which had sunk in 1782 at Spithead, in 90 feet of water. The operations were superintended by General Pasley. Two soldiers of the Royal Engineers, who had for a time exchanged their military garb for the uniform and helmet of the diver, began quarrelling, when at the bottom of the sea, as to the right of ownership in some of the remains. As they were both working at the same part of the wrecked ship, the question was, who should be the master in that particular locality, and who should appropriate the spoil. A fight ensued, during which one of the divers struck his adversary with his fist on the visor of his helmet, and thus broke the glass. He was at once obliged to go up to the surface, and the other laid violent hands on the booty. When all the searches for any objects of value had ended, and they wished to hurry the work of dismembering the ship, they placed charges of powder in all the more massive portions of the vessel, which were fired by means of a voltaic battery. Whenever a mine was exploded, the water rose up in a semi-globular mass, which burst asunder in the middle. Those who assisted at these operations state that it was one of the most impressive sights that could possibly be seen. After each of the explosions, fish, pieces of wood, seaweed of every shade of colour

floated about on the surface of the waves. Although a thousand persons perished in this shipwreck, and the ship was fully laden, very little money was found; but twenty-three pieces of cannon were recovered from among the ruins. The wood of the hull was sold, according to custom, to be made into snuff-boxes and other kinds of ornaments, valued by the curious in such things.*

It is but natural to ask how these undertakings are generally managed in England, when it is proposed to attempt to recover treasure lost in shipwreck. When a ship has sunk, some one of the great marine insurance associations, as, for instance, *Lloyd's*, has the scene of the disaster explored at its own expense, and recovers by the aid of divers the more valuable part of the booty. The remaining portion of the salvage is then sold to some person or company, which gleans at its own cost and risk in this shipwreck-harvest. Thus it was that some years ago, in 1863, the *gleanings* from the water where the *Royal Charter* had sunk were sold

* I saw at M. Siebe's some melancholy and yet interesting relics which had been snatched on this occasion from the bed of the sea—the leg-bone of a sailor, a coffee-mill, a cup, a silver spoon, a silk handkerchief, an old pipe, a bottle of wine, all incrusted round with oyster-shells, &c.; but I was most struck, with the butt-end of a musket, the metal portion of which had been corroded away by the waves. This is the way the sea treats the weapons on which man counts for his defence! This collection ought certainly to be sent to the South Kensington Museum.

for a sum of £1,000. The speculation turned out an excellent one; the divers several times recovered considerable amounts—on one occasion a bar of pure gold weighing nine pounds and a half, and at last, one day (lucky day!), they came upon a box containing £3,000.

The submarine working-field is, in fact, a kind of lottery, and each of the divers looks to gain the great ingot of gold. When the ship becomes buried in a bed of sand, it may remain almost intact for some considerable time. The light depends very much on the depth and on the nature of the water, but generally speaking, the twilight glimmer that prevails is sufficient to guide the movements of the divers round the sunken ship. But the case is altogether different when, having climbed up on the deck, these intrepid searchers seek to make their way into the cabins: there all is dark, horrible, and desolate; they are obliged to feel their way about, like blind men. In large ships, in which the companion-ladders are fixed and deep, and the cabins stretch away into long dark corridors, there is great danger lest the diver should entangle his air-tube round some unlucky object, and thus cut off from his lungs the source of his life. And above all, how is he to find his way back again unhindered through this midnight darkness into the longed-for light? It may be that the diver has found in some mysterious corner the precious treasure-box, and bears it triumphantly in his arms; but what does it profit

him if he is unable to discover the staircase by which he descended into the cabin? The cold, shapeless, dark masses which are floating about round his helmet are the dead bodies of the drowned. If he is fortunate enough to overcome every obstacle and to regain the right road back again, he hastens to send up to the surface the treasure which he has found, and returns to again seek his fortune in the cavern-like hollow of the ship.

The courage of these men is equalled only by their perseverance. I asked one of them if he was not afraid of getting entangled in the heaps of cables and ropes lying about in some of these dark labyrinths; the reply he made was, "If any one is afraid, he'll never make a diver." There are some among their number who really appear to possess a kind of *second sight* in going straight to any hidden treasure; they call this "having the scent at their finger-ends." Of course all are not equally fortunate, but all alike nobly contend with the waves for those buried riches over which hovers hideously the grim image of Death.

Of all the different workers in connection with the sea, the diver is perhaps the one whose duties call him to take a part in the most melancholy scenes. A diver who, in 1865, explored the remains of the *Dalhousie*, a vessel which had been shipwrecked on the coast of Scotland, related a gloomy episode in the history of the great deep. When he went down into the principal

cabin, he found a mother on her knees in an attitude of prayer, and clasping her two little ones in her arms, whilst the other dead bodies were clinging on by their finger-nails to the beams of the ceiling. These sad sights are by no means rare in the experience of a diver. Another of these submarine toilers, who had been engaged in searching a sunken ship on the coast of Ireland, told M. Siebe that when he was in the cabins he often stopped to look at a young woman lying peaceably in one of the berths, whose long dishevelled hair floated about like seaweed with the movement of the water. "I took good care," he added, "not to disturb her in her sleep, nor molest her in her resting-place: where could she have found a more peaceable tomb?" I was also told lately of a young officer whose *fiancée* had been lost in a shipwreck when returning from Australia. He heard it mentioned that the divers who were engaged in searching the remains of the ship had found in it the dead body of a young lady; he set to work to make himself familiar with this mode of operation, and ultimately descended to the sunken vessel. There, in one of the cabins, he, in fact, discovered the remains of a young girl embalmed by the sea-water; one cold white hand was hanging over the side of the berth, on which glistened her "engaged ring." It was indeed his loved one, and he had at least the consolation of seeing her for the last time. But to return to more material subjects.

The sums of money recovered on various occasions from the bottom of the sea by English divers would reach an enormous amount. When Lord Elgin went to the East Indies, the steamship *Columbia* was lost in 1850, off Point de Galle. English divers were sent to the spot, who, assisted by M. Siebe's apparatus, recovered not only money, but also his lordship's papers and despatches. Another steamer, constructed on purpose to run through the American blockade in the late war, and provided with very costly machinery, sunk in the spring of 1865 near Lundy Island. Mr. M'Duff, an engineer from Portsmouth, went down to the vessel clad in the diving-apparatus, took the machinery apart piece by piece, and sent it all up to the surface. He worked in this way six hours a day as coolly as if he had been in his workshop; he was, however, at a depth of forty-two feet under water, and besides, the bottom of the sea was often disturbed by the undulation of the water running in from the Channel. The *Malabar*, a vessel belonging to the Peninsular and Oriental Steam Company, one of the richest maritime associations in the world, having gone down in 1860, remained untouched for several months at the bottom of the deep, and then the divers, equipped with the helmet and apparatus of M. Heinke, managed to recover the whole amount of treasure which was carried in the vessel,—£280,000.

There is every reason to believe that the sea is even

richer than the earth, owing to the millions of shipwrecks which have swallowed up so many a royal fortune. The deceptive vision of all this gold reposing peacefully at the bottom of the ocean has disturbed the sleep of many a diver. Doubtless many a treasure lies hidden in the wave-caressed sands, but where is the spot to seek for it? Where is the key to be found to open these ocean money-coffers? I grant this may be done when one knows pretty nearly the spot of the shipwreck; but who will point out the place in the ocean where the ships of the Armada went down? The wish to explore the unknown regions of the deep has several times suggested the idea of a submarine boat. About the year 1857, Mr. W. E. Newton, an engineer of London, invented an iron apparatus of an oval shape which was to contain air enough to enable several persons to breathe the whole time they were under the water. This boat, which had windows to admit the light, and was besides guided in its submarine voyage by a lighted lamp, was able to descend under water, navigate along under the waves, and then come up again to the surface. It was principally intended for conveying divers about from one place to another. If man ever has it placed within his power to traverse and examine the mighty deep in which lie dormant the relics and the riches of so many a former shipwreck, it will be by some such invention as this.

Much attention has also lately been devoted in Eng-

land to various new plans for raising ships which have recently sunk. Certainly this class of operations does not strictly belong to the subject of my present remarks, but yet the co-operation of divers is indispensably necessary in them. The latter have, to crawl along with their faces to the earth, and to dig out—often through the submarine rock on which the vessel has struck—dark passages and channels before they can get to attack the lower part of the sunken giant, and to fix round it the chains which are to hoist it to the surface. Mr. Page, a celebrated civil engineer, is the inventor of an ingenious process of this kind, a full description of which may be read in the *Times* of September 21st, 1864. I also saw in London M. Euber, a Prusso-American engineer, the inventor of a submarine boat called the *Narval,* who makes it his business to raise sunken vessels from the bottom of the water, and bring them up to the surface. The extent, boldness, and success of his operations well deserve careful attention.

In the various conversations which I had with the divers, I especially endeavoured to ascertain from them what they could tell me as to the nature and appearance of the bed of the sea, but I found that this subject was the very one about which I could get the least out of them. After all, what could I expect? These subaqueous workmen are not artists, and seem very much less intent upon the external features of

the region they visit than they are upon carefully and honourably fulfilling their task. By collecting and comparing all the information which I obtained from them, I fancy that I am enabled to afford some idea of the general appearance of the locality where they pass so considerable a part of their existence. It is, at the present day, generally acknowledged that the bed of the sea is only a prolongation of its coasts; the same rocks, the same geological strata, are continued under the water, gradually sinking, forming angles, zigzags, and parallel undulations. This great abyss may be the remains of a furrow hollowed out between continents, but it is not a chasm or hiatus. The vast body of water constitutes another atmosphere, just as our atmosphere—the air—is an ocean without a shore. It has, too, its seasons, its *aurora borealis*, produced by millions of living sparks, and its own special *flora* and *fauna*.

Strange as it may seem, there are also real submarine landscapes. The surface of the bed of the ocean is pretty nearly as unequal as that of the earth. It forms hills, valleys, table-lands, and immense sandy deserts. The vegetation there is very abundant, and it swarms with animal life. The Whitstable divers complained bitterly to me of the time that it took them to chop away the great reeds with their axes, and to clear the scene of the shipwreck from the aquatic plants which generally overgrew it before they could begin their

operations. Under these clustering masses of plants they often come upon immense conger eels. One of the divers compared the bed of the ocean to a garden formed of sand and planted with shrubs, with the fishes coming to pick off with their mouths the ends of the branches. The fish are the birds of these noiseless groves. In our climate these ocean-shrubs are generally of a very small growth, but I am assured that in the Gulf of Mexico there exist submarine forests of very great size. The colour of the foliage varies also very much according to the climate; and just as in terrestrial vegetation, the plants which live under the water borrow all their brightness from the powerful radiance of the sun. In tropical seas English divers have found large leaves of seaweed of a bright scarlet tint, which had no cause for envy when compared with all the most beautiful vegetable specimens of the virgin forest.

Even on the coast of Great Britain, a diver told me that when he has been working in the clear salt-water on a bright summer's day, many an imposing spectacle has been unfolded to him out of the bed of the ocean. The various kinds of reeds which grow upon the rocks are beautiful in their shape, and on looking up towards the surface of the water, the floating vessel is quite visible above his head, and the air-tube coming down from it seems to bring him news of the upper world. The diver, besides, is seldom or never alone, for the waters are even more populated than the land. At the

bottom of the sea, just as on its surface, there is an horizon by which the visual rays are limited, but the submarine horizon is, of course, much more confined in its extent than the other. Within the narrow circle which is embraced by the sight, all kinds of animated forms appear from time to time, like ships under sail on the upper horizon. Very often it may be a shoal of small fish, which are swimming for their lives to escape from the pursuit of one of the devouring ogres of the ocean. On the contrary, when all is quiet, the fish, attracted no doubt by the metallic glitter, come and swim round the head of the diver like a flight of small birds, and will even imprint a kiss with their mouths on the outside of the helmet. Some of them will occasionally take more audacious liberties with their strange visitor. Not long ago a diver was bitten in the shoulder by a dog-fish.

As the English divers have worked in nearly every sea without ever having been attacked by sharks, it has been thought that these ferocious creatures are scared away at the sight of such Tritons as the divers appear to be, with their heads covered with their plated leather helmets. Besides, are they not provided with their dagger-knives, which are much more practical weapons against the voracious appetites of these monsters? The Prussian engineer of whom I before spoke, M. Euber, seemed, however, but little convinced of the efficacy of the diver's equipment as a means of

intimidating enemies of this sort. He himself had been working for about an hour on the scene of a shipwreck, when, by the fantastic light of the sea, he fancied that he perceived a sunken vessel at some distance off which he had not before remarked. He went forward to examine the unknown object; but it was in motion, and glided through the water without any visible movement, darting forth fearful glances, and shedding a kind of livid glimmer. There was no mistake this time; it was certainly a shark. M. Euber, with his companion, turned to seek refuge behind the shattered hull of the shipwrecked vessel. Their position was a critical one. Their friends, not receiving any signals from them, might at any moment hoist them up to the surface; this would have given a great advantage to the monster in attacking them, they therefore made up their minds to cut the rope. The creature came occasionally to watch them, glaring at them through the displaced planks of the ship. They fancied they could discover some signs of astonishment in his cruel physiognomy; he certainly had never before met with anything in the sea of a similar appearance: his surprise, therefore, was not to be wondered at. The two divers had made every preparation to sell their lives as dearly as possible; but, after mature deliberation, the shark slowly took himself off.

Up to the present time, the sea has given back to man very little more than it has first snatched from

him. The diver disputes with the waves for the relics of their prey; he goes down into the gulf to seek for the riches which the gulf has first swallowed up. And yet the ocean must be a vast field of production. The coral reefs and the pearl-oysters, the natural wealth of certain parts of the sea, are well calculated to tempt the ambition of modern enterprise. As yet this extensive mine of riches has been explored only by unarmed and naked divers, who can remain scarcely one minute under water, and have but little time to select and secure their booty. In 1865, a diver, clad in full submarine equipment, was employed for the first time to get up pearls and sponge. His harvest was a fruitful one, and there is every reason to believe that at some future day this system will be extended over the area of the South Seas—those vast *dépôts* of mother-of-pearl, coral, madrepores, and precious shells.

It is said in the Book of Wisdom; "Who can find out the deep?" The diver has now raised at least a corner of the veil which hid from the ancients all the secrets of the deep. And yet, unless some important change takes place in the construction of the diving-apparatus, there are ocean depths that the eye and hand of man can never reach. The diver who, up to the present time, has touched the deepest point in his descents, went down 165 English feet in the Mediterranean Sea; but he was obliged to load his belt with balls of lead, and was not able to remain more than

twenty-five minutes under water. "One hundred and twenty feet! Certainly it seems a great depth; but when we hear of twenty-five thousand feet of water in certain parts of the Atlantic, it is enough to make one give up the contest in despair. Beyond forty or forty-two metres down, the light begins sensibly to diminish. Can there be a point where light ceases to exist? There is, I think, every reason to conclude so.

At depths where the rays of the sun cease to penetrate to the bottom of the sea, vegetation disappears, for marine plants, like their terrestrial fellows, are equally dependent on the fostering luminary. Vegetable life, however, seems to fade away in these extreme depths much more than individuals of the animal kingdom. From ocean depths in which, according to the calculations of science, darkness perpetually prevails, the sounding-line has brought up *infusoria* and various diminutive molluscs, the delicate shells of which, when touched, crumble away under the fingers. It is most astonishing that, under examination through the microscope, they are all found to have eyes, though what use these organs could be to them in the vast unilluminated deserts of the deep, it would be difficult to say. In all probability these animals have not always lived at the bottom of the sea; they increase and multiply until they are more numerous than the sea-shore sand in the water which flows near the surface. It is only after death that they descend into their dark

burial-places, where their forms are preserved as in life, for it seems that the ocean at these great depths possesses the property of embalming its dead.

The surface of the sea is considered to be the type of fickleness, but its lowest depths must be the image of eternal immobility. Of all created things the bed of the ocean is that, perhaps, which changes least. The great body of water forms a sort of barrier, placed between the outer atmosphere and the plains of ocean, and intercepts the influence of all disorganising causes. There, down in these fathomless depths, in these regions devoid of the sun, eternal silence, eternal rest, and eternal night hold their unruffled reign. There no change of seasons disturbs the one uniform temperature, and as the naturalists say, an isothermal base stretches, as we have every reason to believe, from the equator to the pole. But yet the bed of the sea, though so well protected against all the external agencies which are gradually changing everything on the surface of the earth, is not itself invulnerable to certain successive modifications. The unceasing snow-fall of the remains of animated creatures sinking down from the upper waters must slowly form new strata. The same geological and natural causes which, during the long night of ages, have piled up the vast banks of shells, deposited masses of chalk, and bit by bit built up the coral isles, are still pursuing their course in the midst of these gloomy solitudes. The

deepest beds of ocean are continually being overspread with an ever-thickening cloak of lifeless organisms. These seem the only certain data that the sounding-lead, in default of the eye and hand of the diver, has been enabled to afford us as to the nethermost depths of the sea. Our present continents were once the beds of dried-up oceans: will our seas some day form the soil of future continents? Many English geologists have but little doubt of this; but it will be sufficient here if we have pointed out a few of the actual facts connected with the physical geography of the ocean. The establishment of the system of ocean-telegraphs, by rendering necessary such vast operations of submarine exploration, has very much contributed to extend the horizon of man's knowledge of these subjects. Thus in the year 1850, when there was a question of laying down a telegraphic cable between Newfoundland and Ireland, the necessary preliminary inquiries caused the discovery of a line of cinders and volcanic remains extending over a length of a thousand miles at the bottom of the sea.

The desire of knowledge is one great feature which distinguishes modern communities. The sea has no depths, the rocks have no caverns, and the waters have no solitude which can now-a-days escape the bold curiosity of man. The diver holds a high place in this brave army of inquirers. His helmet on his head, and equipped cap-a-pie against the hostile element,

the knight-errant of the seas opens out a path for the enterprise of science and genius. Doubtless it is true that it is the desire of riches and the pursuit of his trade which attract him to the bottom of the seas, and not the aspirations of a mind eager for information; but has not this been always the case? Even when he believes that he is acting for his own advantage, and his own advantage only, still it is the Unknown and the Undiscovered that he is pursuing. The whalers were the first in days gone by to direct the attention of science to the geography of the poles, and the physical characteristics of the ice-bound seas. What, too, was the object of the sanguine adventurers who, with Columbus at their head, launched forth on to the broad Atlantic? They hoped to grasp a visionary prey in the fancy-figured lands floating on the far-distant wave; they looked for gold, but they found a world.

THE END.

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